

STATUS OF HARLEQUIN DUCKS (*Histrionicus histrionicus*) IN NORTH AMERICA

Report of the Harlequin Duck Working Group

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Disclaimer- This report is a compilation of information gathered throughout North America. It does not necessarily represent the official positions of the contributing organizations or the individual authors.

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INTRODUCTION

The holarctic harlequin duck (Histrionicus histrionicus) occurs in at least two disjunct populations in North America; Atlantic and Pacific (Figure 1). The Pacific population has always been considerably larger than the Atlantic (Bent 1925, Bellrose 1980). However, until recently, little information was available on population size, trend, or natural history of the species outside Iceland. Recent studies have increased knowledge of harlequin duck distribution, population dynamics, and habitat requirements (compiled in Cassirer 1992). In the course of these studies, actual and possible population declines have been documented throughout the species' range. The purpose of this report is to summarize the available information on the distribution, population size and trend of harlequin ducks in North America, and to identify potential threats and information needs.

LIFE HISTORY

Wintering and nonbreeding ecology

Harlequin ducks winter along northern coastlines, usually near reefs, rocky islands, and cobble beaches. Coastal numbers are greatest from October through March or April (Campbell et al. 1990, Byrd et al. 1992), although nonbreeding and immature individuals may remain on the ocean year-round. Pair bonds are

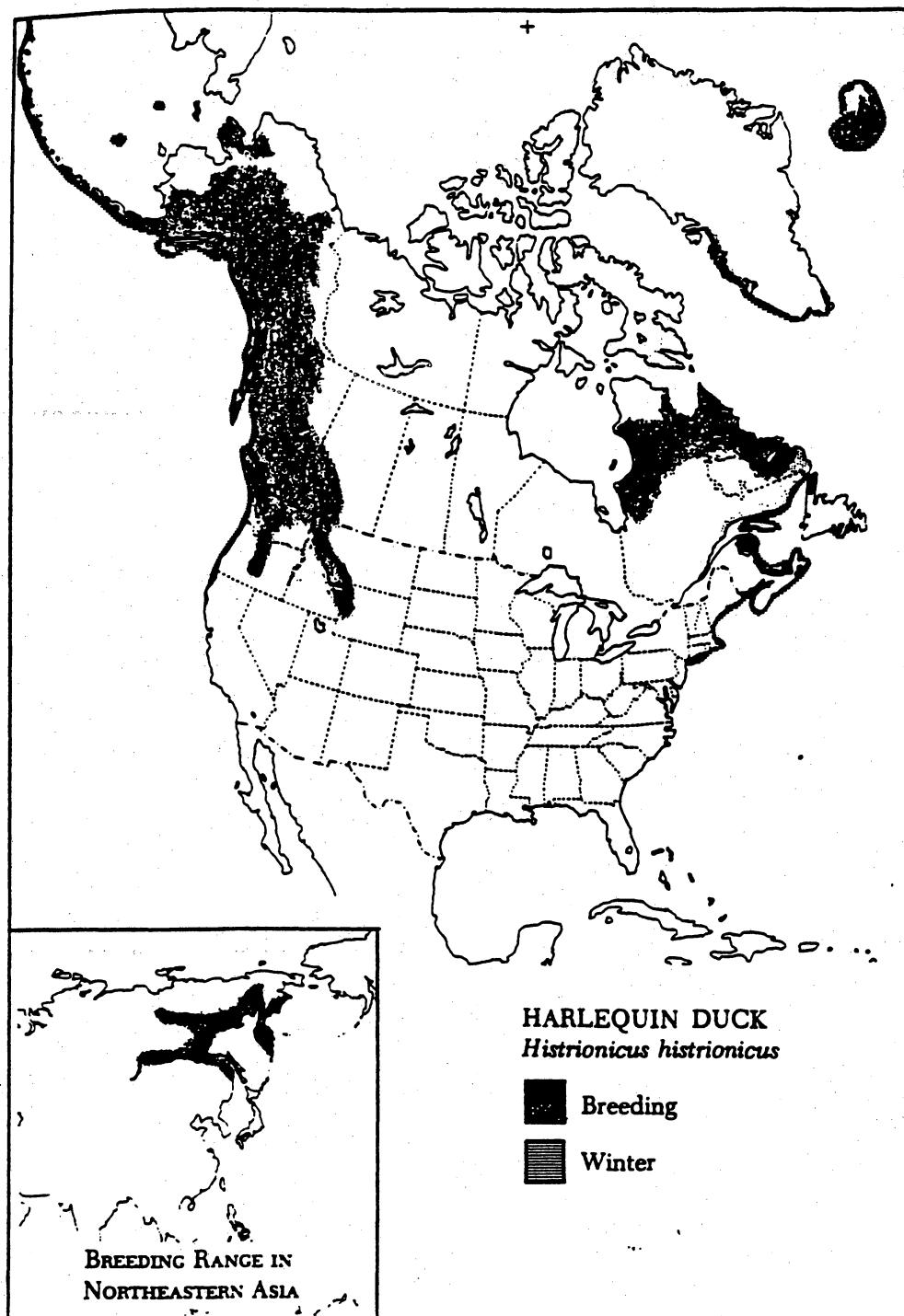


Figure 1. Global distribution of harlequin ducks (modified from Palmer 1976).

likely formed in coastal areas. Individuals are thought to exhibit fidelity to both molting and wintering areas (Savard and Breault in prep.).

Distribution of harlequin ducks along the coast shifts within and among years (Schirato and Sharpe 1992), partially due to food availability (Chadwick 1992). Marine foods include crustaceans, gastropods, and other invertebrates (Vermeer 1983, Goudie and Ankney 1986, Gaines and Fitzner 1987), and roe (Vermeer 1983, Chadwick 1992).

Sex ratios on wintering areas are biased towards males in most areas (British Columbia 60% males, 40% females or apparent females, Campbell et al. 1990, Chadwick 1992; Amchitka and Shemya Islands, Alaska 53-56% males, Byrd et al. 1992). However, in some areas females and juveniles predominate (Adak Island, Alaska 46% males, Byrd et al. 1992; Maine 48% males, 52% apparent females, Mittelhauser 1991). Summering ratios of males in some areas of coastal British Columbia increase to 95% (Campbell et al. 1990).

Migration

Harlequin ducks migrate from the coast to breeding areas from March through June. Migration probably involves a combination of swimming and flight, and may be influenced by weather and snow conditions encountered enroute. Return migration to the coast in summer and fall is thought to be

relatively rapid (Wallen 1987). Little is known about migration routes, although they are thought to follow stream corridors (Bengston 1966). Birds evidently fly over the continental divide to breed along the Rocky Mountain Front.

Harlequin ducks marked on breeding streams in northern Idaho and northwestern Wyoming have been found along northwestern Washington coastlines and the southern Gulf Islands, British Columbia during July, August, and October (Wallen 1991; Cassirer and Groves 1992, unpubl. data).

Breeding ecology

The harlequin is the only duck in the northern hemisphere to breed almost exclusively along swiftly flowing mountain streams. Within their breeding range, harlequin ducks nest only along a select number of clear streams with rocky substrates. Stream types range from braided to reticulate, with an abundance of riffle and rapid habitats. Some use of mountain lakes and lake outlets has been documented in the Canadian Rockies (Clarkson 1992) and Iceland (Bengston 1972). Bank vegetation is highly variable, from moorland in Iceland, spruce forest and willow thickets in Labrador, willow shrub or pole or immature-sized lodgepole pine (*Pinus contorta*), Engelmann spruce (*Picea engelmannii*), and Douglas-fir (*Pseudotsuga menziesii*) forest in the Rocky Mountains (Wallen 1987, Atkinson and Atkinson 1990, Diamond and Finnegan 1992), to mature or old-growth western

redcedar (*Thuja plicata*) - western hemlock (*Tsuga heterophylla*) in the Pacific northwest (Cassirer and Groves 1991).

Both pairs and bachelor drakes migrate to breeding areas. Unpaired hens are extremely uncommon on the breeding grounds during spring. Spring sex ratios on breeding streams average 55-64% males (Bengston 1972, Kuchel 1977, Inglis et al. 1989). Harlequin ducks maintain a multi-year pair bond, and both pairs and bachelor drakes exhibit strong fidelity to breeding streams (Kuchel 1977, Wallen 1987, Cassirer and Groves 1991).

Harlequin ducks usually nest close to streams, but nesting habits are highly variable. Nests may be on the ground in dense vegetation, in rocky cavities, piles of woody debris, undercut streambanks, or in cliff cavities above the stream, or hollow trees or snags in the adjacent forest. Nests are extremely well-hidden, and are often, although not always, upstream of pair activity areas (Bengston 1972, Cassirer et al. *in press*).

Breeding chronology is asynchronous, but tends to be delayed in areas with later snowmelt such as Grand Teton National Park (Wallen 1987). Egg laying and incubation generally occur during May and June. At the start of incubation, the drakes return to the coast, eliminating the possibility of renesting. During late June and early July nonbreeding, possibly immature, hens appear on the streams and remain until after hatching occurs in June and July. Nonbreeding and unsuccessful hens migrate to the coast in July. Successful hens remain on the streams with the ducklings,

although up to 40% abandon their broods before fledging (Wallen 1987, Cassirer and Groves 1991).

Brood size at fledging averages 2.6 - 4.5 (Bengston 1972, Kuchel 1977, Dzinbal 1982, Wallen 1987, Cassirer and Groves 1991). Ducklings return to the coast in the summer and fall after fledging. Males do not attain full breeding plumage until after their second winter and in general harlequin ducks do not breed until after their first year.

Productivity appears to be influenced by stream runoff (Kuchel 1977, Genter et. al 1993) and food availability (Bengston and Ulfstrand 1971, Gardarsson and Einarsson 1991). Harlequin ducks feed mainly on benthic invertebrates (Pool 1962, Bengston and Ulfstrand 1971) and roe (Dzinbal 1982) on breeding areas.

MANAGEMENT STATUS

Harlequin ducks were listed as endangered in eastern Canada in 1990, and in 1991 were designated a C2 candidate¹ for threatened or endangered status throughout the United States. The hunting season was closed on the Atlantic population in 1989, and designation as a state threatened or endangered species in Maine is expected in 1993.

Harlequin ducks in the Pacific population are classified as

¹ Taxa for which information now in possession of the U. S. Fish and Wildlife Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.

a migratory game bird with bag limits of 4 per day in Washington, Oregon, and California, 6 per day in British Columbia, and 15 per day in Alaska. They are also classified as a state sensitive species in Oregon, a priority habitat species in Washington, and a species of special concern in Idaho and Montana. These designations are not accompanied by statutory protection. The harlequin duck is a U. S. Forest Service sensitive species in the Northern, Rocky Mountain, and Pacific Northwest Regions. According to Forest Service policy, protection of sensitive species involves implementation of management practices to ensure that populations do not become threatened or endangered. In British Columbia, harlequin ducks were recommended by the Canadian Wildlife Service as an indicator of pristine ecosystems in the Tatshenshini proposed wilderness area. as51

DISTRIBUTION

Atlantic population

Currently, the Atlantic population of harlequin ducks in North America winters in Newfoundland, New Brunswick, Nova Scotia, Quebec, Maine, and south intermittently along the east coast with local concentrations off the coasts of Rhode Island and Cape Cod, Massachusetts. Known breeding occurs in northern Newfoundland, Labrador, and Quebec (Goudie 1991) (Figure 2). Harlequin ducks also winter and breed in Greenland and Iceland. There is no evidence of any exchange between the eastern North

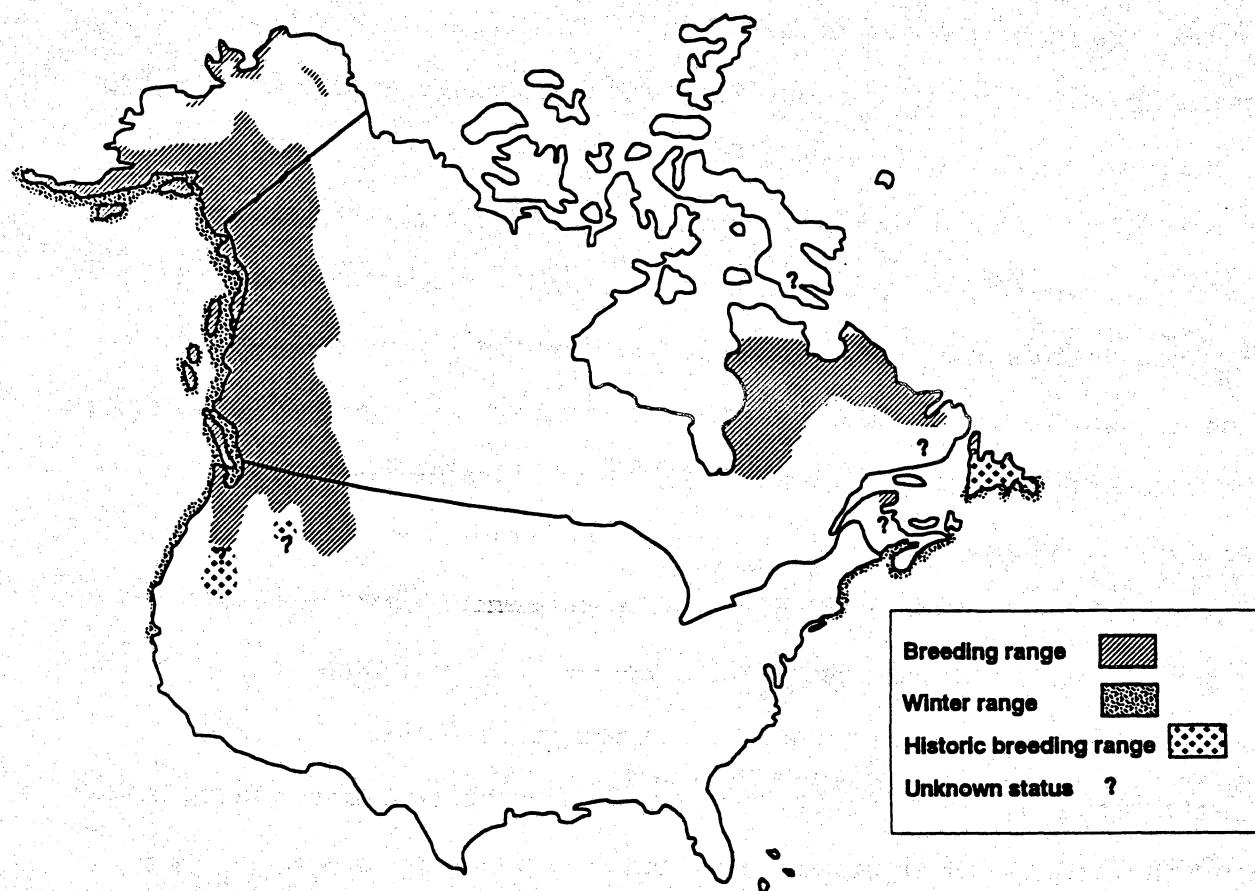


Figure 2. Distribution of harlequin ducks in North America, 1993. Breeding status is unknown on Baffin Island, New Brunswick, and Quebec north of the gulf of St. Lawrence in the Atlantic population. Status is unknown in the Blue Mountains of Oregon and Washington, the southern Cascades of Oregon and many areas of western Canada and Alaska in the Pacific population.

American, Greenland, and Icelandic populations.

Although historical information is limited, harlequin ducks were apparently once widespread in the northern Atlantic (Goudie 1989, 1991). Some historical breeding areas are no longer occupied, and wintering is restricted to localized refugia within the historic range (Figure 2, Goudie 1991).

Pacific population

The Pacific population of harlequin ducks in North America currently winters in coastal areas of Alaska, British Columbia, Washington, Oregon, and into northern California. Breeding occurs in Alaska, British Columbia, Washington, Oregon, and northern Idaho, east to the eastern slopes of the continental divide in Alberta, Montana, and south to northwestern Wyoming and southeastern Idaho (Figure 2). Harlequin ducks also winter and breed in northeastern Asia (Dementev et al. 1967).

In the United States outside Alaska, breeding stream surveys and incidental reports have documented harlequin duck use on 251 second-order or larger streams (Table 1). Actual nesting activity has not been documented on all streams used by harlequin ducks during the breeding season. Some streams may be used only

Table 1. Documented use of streams by harlequin ducks in the United States Pacific population outside Alaska, 1993.

State	Number of streams known to be used by harlequin ducks
Washington	118
Oregon	39
Idaho	35
Montana	40
Wyoming	19
California	0
Total	251

for feeding and/or travel. Number of breeding streams in western Canada and Alaska is unknown.

Although historical information is incomplete for most areas, both breeding and wintering distribution appear to be declining in the Pacific population. Harlequin ducks have disappeared both from peripheral areas where they were formerly present but rare, and from centrally located areas where they were once relatively common. Reductions in the Pacific breeding distribution have been documented primarily in the eastern and southern parts of the range (Figure 3).

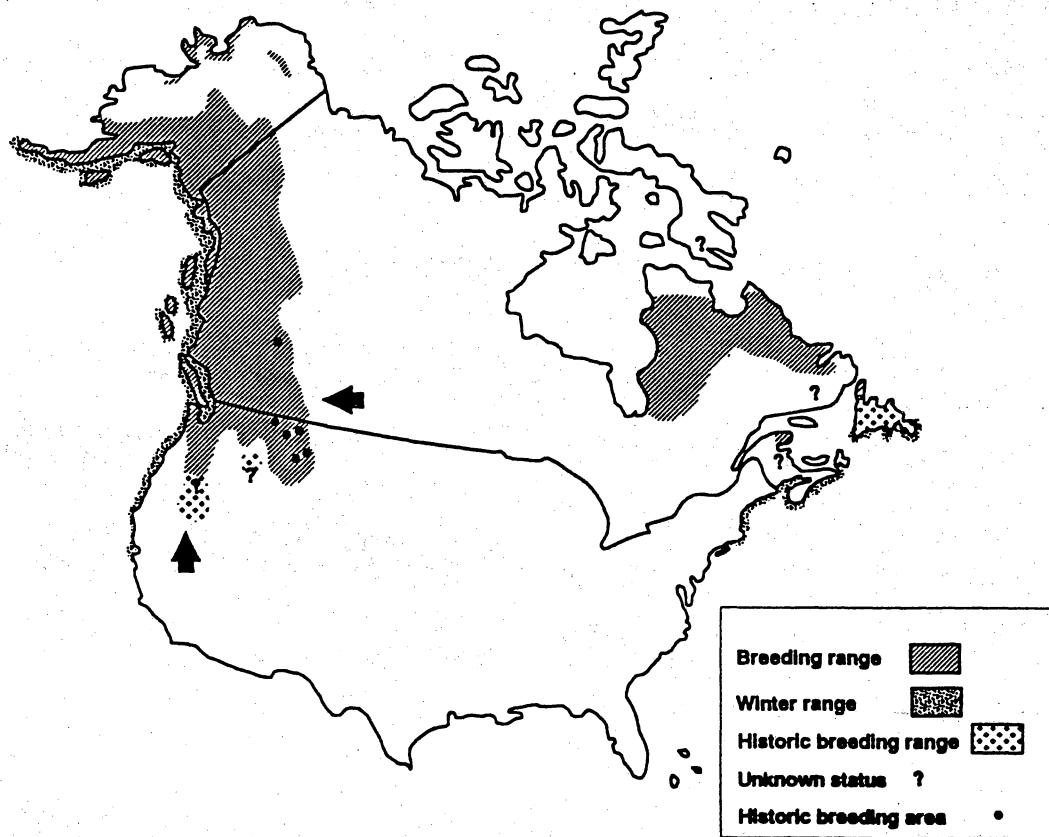


Figure 3. Distribution of harlequin ducks in North America, 1993. Arrows indicate direction of apparent reduction in the Pacific breeding range. Dots are approximate locations of historic breeding streams that are no longer occupied.

North American wintering areas include U.S. Fish and Wildlife Service and Canadian Wildlife Service Refuges, National and Provincial Parks, and U.S. Coast Guard, Dept. of Defense, and private lands. Breeding areas are located primarily on National Forests or Crown Land and National or Provincial Parks, as well as Bureau of Land Management, and private lands.

POPULATION SIZE AND TREND

Atlantic population

The Atlantic population in North America is estimated at under 1,000 individuals and has exhibited a significant decline in this century (Goudie 1989, 1991). Declines continue in all areas except southern New England where a small population (60-80) of wintering harlequins is increasing (Table 2).

Table 2. Harlequin duck population trend at monitoring sites in eastern North America.

Location	Population trend ¹	Years monitored	Type of monitoring
Newfoundland	declining	1979-1991	Christmas bird counts
Nova Scotia	declining	1975-1991	Christmas bird counts
Maine	declining	1988-1992	Shoreline surveys
Rhode Island	increasing	1984-1988	Christmas bird counts

¹ all trends are significant ($P < 0.05$)

Pacific population

The Pacific population in North America has always been larger than the Atlantic, but has likely been overestimated in the past (Bellrose 1980). Wintering population sizes are unknown outside of localized areas. Roughly 1,500 winter in Washington (Schirato and Sharpe 1992), tens of thousands in British Columbia (Campbell et al. 1990, Breault pers. comm.) and 150,000 in the Aleutian Islands, Alaska (Byrd et al. 1992).

An estimated 500-600 pairs breed in the Pacific Northwest and Rocky Mountains in the U. S. (Table 3). An unknown number breed in western Alberta, and in British Columbia and Alaska where they are considered much more common. Monitoring of selected breeding and wintering sites over the past 3-15 years

Table 3. Estimated United States harlequin duck breeding population in the Pacific Northwest and Rocky Mountains.

State	Estimated number of breeding pairs
Washington ¹	274
Oregon ²	50
Idaho ²	50
Montana ¹	110
Wyoming ¹	40
Total	514

¹ Minimum estimate.

² Maximum estimate.

has documented stable to declining populations in most areas (Table 4).

Table 4. Harlequin duck population trend at monitoring locations in western North America.

Location	Population trend	Years monitored	Type of monitoring
Aleutian Islands			
Adak	declining ^{1,3}	1983-1992	shoreline surveys
British Columbia		1975-1991	Christmas bird counts
Comox	declining ¹		
Nanaimo	declining ¹		
Pender Islands	declining ¹		
White Rock	declining ¹		
Deep Bay	declining ²		
Ladner	increasing ^{1,4}		
Victoria	increasing ^{1,4}		
Vancouver	increasing ^{2,4}		
Alberta			
Jasper N.P.	declining ²	1986-1991	point monitoring
Maligne River			
Idaho	stable	1990-1992	breeding stream surveys
5 breeding streams in N. Idaho			
Montana		1988-1992	breeding stream surveys
2 breeding streams	declining		
2 breeding streams	stable		
1 breeding stream	increasing		
Wyoming			breeding stream surveys
4 breeding streams GTNP	stable	1985-1992	

¹ trend not significant ($P > 0.05$).

² trend significant ($P \leq 0.05$).

³ competition with an expanding sea otter population may be involved in decline.

⁴ increases may be due to increasing numbers of observers in urban areas.

PRODUCTIVITY

On average, only 12-56% of paired females on a breeding stream successfully produce any ducklings to fledging in a given year (Bengston and Ulfstrand 1971, Kuchel 1977, Wallen 1987, Cassirer and Groves 1991). Duckling survival to fledging ranges from 45-80%. Productivity is highly variable from year to year. Lack of productivity is due both to nonbreeding and failed breeding by paired hens, (Bengston and Ulfstrand 1971, Dzinbal 1982, Cassirer and Groves 1991). In an increasing population in Iceland, productivity measured over a 15 year period varied from 0.1 to 3.3 ducklings fledged per hen annually, and averaged 1.1 ducklings per hen per year. (Gardarsson and Einarsson 1991). Some ducklings eventually return to their natal streams to breed (Kuchel 1977, Wallen 1991). Recruitment rate is unknown.

RETURN RATES

Return rates of banded or nasal-marked adults to breeding streams were 63% in Idaho (n = 31), 40% in Wyoming (n = 54), and 67% in Montana (n = 12, Kuchel 1977). Return rate of juveniles appears to be low, but is not well documented. At least 5 females of 103 ducklings banded in Grand Teton National Park 1987-1990 have returned and nested successfully (Wallen 1991).

MORTALITY

Atlantic population

In eastern North America, the primary mortality factor prior to hunting season closure appears to have been harvest by sport hunters. This may have been the main factor driving the population to its current imperiled status (Goudie 1989). Aboriginal, subsistence, and illegal harvest continue (Goudie 1991). Historically, hunting was also a mortality factor in Maine, but since the season closure in 1989 illegal harvest is considered very low.

Oil spills and chronic pollution are also potential mortality factors in the Atlantic population.

Pacific population

The extent of hunting mortality in the western population is unknown, however it is assumed to be low outside locally popular areas in Alaska. Few birds are checked by wildlife officials in Oregon, Washington, or British Columbia, and only one band return has been reported from over 300 birds banded on breeding areas in Washington, Idaho, Montana and Wyoming, and wintering areas in British Columbia. Some commercial poaching for sale as mounts occurs in Alaska, and possibly elsewhere.

Collecting permits have been issued in Montana (1), Washington and Alaska, but the total extent of collecting is unknown. Due to the low success of captive breeding, there is a

market for harlequin ducks, with adult pairs valued at \$2,000 or more (C. Pilling, aviculturist, pers. comm.).

Harlequins suffered significant mortalities in the Exxon Valdez oil spill in Prince William Sound, Alaska, and birds remaining in the area are subject to chronic reexposure to oil from contaminated mussel beds (Patten 1993). Harlequins ducks may be affected by oil and other pollution throughout the Pacific coast.

Natural mortality in both populations is not well documented.

THREATS

Harlequin duck population regulation appears to be a complex mechanism affected by a number of factors. Potential human-caused threats to population viability include (not prioritized):

Habitat degradation in breeding and wintering areas including:

- destruction of riparian areas along breeding streams.
- destruction of watershed stability and stream flow regime on breeding areas by mining, roading, or timber harvest.
- inundation or elimination of breeding habitat by river impoundment and/or diversion.

- destruction of the larval insect food base through biting fly control programs in the northeast.
- encroachment of shoreline development and commercial activities on wintering areas.
- disturbance by recreational river users and hikers in breeding areas.
- oil and other contaminants on food. *Latitude summer winter*

Mortality factors including:

- Overharvest of remnant populations on wintering areas as likely occurred and may be continuing to occur in the Atlantic.
- Oil and other contamination in coastal areas. Besides being an immediate mortality factor, residual oil may chronically recontaminate birds and eliminate reproduction (S. Patten 1993).

MANAGEMENT

Monitoring

Although harlequin ducks are missed in most wintering waterfowl counts, the species is included in marine bird surveys and winter waterfowl counts in the Alaska Maritime National Wildlife Refuge (Byrd et al. 1992). Other localized areas throughout the breeding and wintering range in both populations are monitored on a year to year basis pending funding and

OCFAP

personnel. There is currently no long term funding commitment for monitoring harlequin ducks, although monitoring has been identified as a priority in the draft Canadian eastern North American Recovery Plan.

Population and habitat management

*forest/ Park
plans & xc*

Harlequin ducks in the Atlantic population are legally protected from harvest. However, hunter education programs and additional law enforcement are needed. Harlequin duck hunting in the Pacific population is covered under the general sea duck regulations. Washington has established habitat management recommendations for harlequin ducks (Rodrick and Milner 1991). No other state or agency has developed a management plan for harlequin duck habitat.

INFORMATION AND RESEARCH NEEDS

Additional information is necessary for adequate management of harlequin ducks on both coasts. Many of the same questions need to be answered in both areas. Information needs include:

Atlantic population

- Conduct additional inventory of breeding, wintering, and staging areas to better document population size and distribution.

Additional wintering area inventory is needed on the outer coast of Atlantic Canada and the northeastern United States.

Additional breeding area inventory is needed throughout eastern Canada, including Baffin Island, New Brunswick, Quebec, and Newfoundland.

- Set up regionally consistent, statistically valid monitoring programs throughout the breeding and winter range.
- Examine productivity, survival, and recruitment rates. Identify causes of juvenile mortality.
- Investigate food habits and feeding requirements in breeding areas.
- Investigate movement, migration, and dispersal patterns between and within breeding and wintering areas. Examine genetic differences among breeding areas. Assess whether any birds move between eastern North America, Greenland, and Iceland.
- Conduct research into the effects of human disturbance, forestry practices, river impoundment, and insect control on breeding areas. Investigate possibilities for mitigation and habitat restoration.

- Examine the impacts of oil contamination, including chronic low level oil pollution in near shore environments.
- Conduct a status review to determine if federal protection of the Atlantic population in the United States is warranted under the Endangered Species Act.

Pacific population

- Conduct additional inventory in breeding and wintering areas to better document population size and distribution.

Additional wintering area inventory is needed in California, Oregon, British Columbia, and Alaska. Breeding inventories are needed in the Cascade and Blue Mountains of Oregon and Washington, northeastern Washington, central and southeastern Idaho, in the Bitterroot, and Upper Yellowstone River drainages in Montana and in northwestern Wyoming outside the National Parks. Breeding inventories are also needed throughout British Columbia, western Alberta, and Alaska, both within and outside National and Provincial Parks.

- Set up regionally consistent, statistically valid monitoring programs throughout the breeding and winter range.

- Examine productivity, survival, and recruitment rates.
Identify causes of juvenile mortality.
- Investigate movement, migration, and dispersal patterns within and between breeding and wintering areas. Examine genetic differences among breeding areas.
- Conduct research into the effects of human disturbance, forestry practices, and river impoundments on breeding areas. Investigate possibilities for mitigation and habitat restoration.
- Examine the impacts of oil contamination, including chronic low level oil pollution in near shore environments.

- Harvest impacts

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APPENDICES

State and provincial status reports

HARLEQUIN DUCK STATUS REPORT 1992

IDAHO

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DISTRIBUTION

Historical

Limited historical information consists of one breeding record (Hand 1941) and four sight records (Merrill 1987, Rust 1915; Hand 1932, 1941) on three streams in northern Idaho (46°30'N, 114°57'W to 47°58'116°15'). All reports characterized harlequin ducks as rare. Burleigh (1972) considered harlequin ducks uncommon summer residents in the northern part of the state, from the Lochsa River (46°30'N) north.

No substantiated historical information exists on migration routes of harlequin ducks breeding in Idaho, although Burleigh (1972) stated that they migrate to the coasts of Washington and British Columbia.

Occasionally single individuals are observed on the Snake River in winter (Christmas Bird Count), but in general, harlequin ducks do not molt or winter in Idaho.

Current

Current breeding distribution, while not completely known, is well-documented; based on surveys of 80 streams from 1987-1992 and widespread distribution of a poster asking for reports of harlequins (Cassirer et al. 1991, unpubl. data). Harlequins are known to use 35 streams in northern (45°45'N; 115° 45'W to 49°00'N; 117°02'W) and southeastern Idaho (43°50'N; 111°50'W to 44°50'N to 111°50'W). Breeding has been confirmed on 15 streams, from 45°,50'N; 115°45'W to 49°00'N; 117°02'W. The three historical streams mentioned above are still occupied, although one probably has only a few ducks on it. No harlequin ducks were observed in 1990 or later on at least two breeding streams occupied prior to 1988 (Cassirer 1991, unpubl. data).

Breeding stream reaches in northern Idaho are generally swiftly flowing, forested, and in unlogged areas, or areas with a mature or old-growth buffer along the stream, with relatively low human use, 50 m or greater from a road (Cassirer and Groves 1991, 1992). Riparian shrubs and overhanging vegetation with a younger overstory were typical of areas where harlequins were observed in southeastern Idaho (Atkinson and Atkinson 1990). Most stream reaches used by harlequin ducks are on public land; primarily U.S. Forest Service. Some are on Idaho state land. Few streams cross private land.

Harlequins are generally present in Idaho from April through mid-September. Early reports in March and early April suggest harlequins occasionally stop on lower stream reaches and lakes in the state during a fairly rapid migration to breeding areas. Two nonbreeding hens radioed in northern Idaho were located near the San Juan and Gulf Islands in Washington and British Columbia in late July and early August. A drake banded as a duckling in northern Idaho in 1991 was shot in October 1992 at Oak Harbor, Washington (Cassirer and Groves 1992, unpubl. data).

POPULATION STATUS

Harlequin ducks are classified as a state species of special concern and a U.S.F.S. sensitive species in Idaho. Total breeding population is estimated at 50 pairs or less (Cassirer et al. 1991). Population density ranges from 0.06-0.53 pairs/km (median 0.27 pairs/km, average = 0.22 pairs/km, n = 8 streams, 1-3 years data per stream). Populations on six streams monitored from 1989 or 1990 through 1992 suggest that the population has been stable during this period. Estimated pair numbers on 5 streams monitored from 1990-1992 were, 1990;15, 1991;13, 1992;16.

PRODUCTIVITY

An average of 36% (range 27-53%, median 29%, n=3 years) of pairs in northern Idaho produce broods to fledging. Three of four nests found in Idaho were successful, the one failure was due to infertile eggs and may have been caused by researcher interference (Cassirer and Groves 1992, unpubl. data).

Duckling survival to fledging was 73% in 1991, and 45% in 1992. Median brood size at fledging is 3 (average = 3.33, n = 21). Duckling mortality sources are unknown. Although 23 ducklings were banded 1988 - 1991, only one possible recruitment into the breeding population has been documented (Cassirer unpubl. data).

MORTALITY AND RETURN RATES

One band return has been received from 71 birds banded. Sixty-three percent of 30 adults individually nasal-marked or color-banded between 1988-1991 have returned at least once after banding. Eighty-nine percent (8 of 9) adults marked 1988-1990 that returned once continued to return for up to 4 years as of 1992 (Cassirer and Groves 1992, unpubl data).

HARVEST

Insignificant in the state. Only one known harvest on the Pend Oreille River in northern Idaho. Most harlequins have migrated from Idaho by waterfowl season. No collecting permits have been issued.

MANAGEMENT

No organized population monitoring is in place outside of research projects. No habitat guidelines exist, although informal consultation occurs with Forest Service biologists. Cassirer and Groves (1991) contains habitat recommendations for buffer strips and management of human activities on breeding streams.

THREATS

Logging, roading, mining, grazing and recreation (fishing and rafting) occur singly or in combination in most of the drainages used by harlequin ducks. These should be addressed in a state or regional habitat management plan for harlequin ducks.

Coastal activities- oil spills, hunting- may also potentially affect harlequins breeding in Idaho. Cooperation with states and provinces managing wintering areas should be continued.

INFORMATION NEEDS

Conduct two additional seasons of stream surveys to refine information on distribution and population size in central and southeastern Idaho.

Establish a statistically valid statewide monitoring plan.

Establish state or regionwide habitat management guidelines.

Conduct long term (10 year or more) research on harlequin numbers and productivity in relation to land management activities, stream flows, weather and invertebrate densities, preferably on streams where several years of population data currently exist.

Examine causes of duckling mortality.

Determine the extent of genetic differences between harlequins breeding in Idaho and other areas.

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HARLEQUIN DUCK STATUS REPORT 1992

MONTANA

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DISTRIBUTION

Historical

Nesting in the Rocky Mountains was first documented in Montana by ornithologist Elliott Coues in 1874. Broods of young harlequins were encountered in a "clear, ice-cold mountain stream" near Waterton Lake (from Thompson 1985). Harlequin ducks have always been considered uncommon and rarely seen. In 1881, James C. Merrill, an Army naturalist stationed at Fort Custer (Hardin, MT), found several pairs breeding in the Bighorn Mountains area, probably in the whitewater area of Bighorn Canyon ($45^{\circ} 28'N$, $107^{\circ}41'W$). As late as 1921, harlequins had been reported from only three additional localities: Flathead Lake ($48^{\circ}00'N$, $114^{\circ}10'W$), the West Gallatin River ($45^{\circ}42'N$, $111^{\circ}13'W$), and Birch Creek ($48^{\circ}06'N$, $112^{\circ}53'W$) (Thompson 1985). Other records for 1935 include sightings at Badger Creek ($48^{\circ}15'N$, $113^{\circ}10'W$) and the South Fork of the Sun River ($47^{\circ}45'N$, $112^{\circ}55'W$), along the Rocky Mountain Front (Diamond and Finnegan 1992). Anecdotal reports of harlequin ducks in recent decades include the upper Stillwater River ("several pairs" - R. Elger; $45^{\circ}20'N$, $109^{\circ}50'W$) and Boulder River (up to 8 pairs - R. Eng; $45^{\circ}51'N$, $109^{\circ}55'W$) of southcentral Montana; Rattlesnake Creek ($46^{\circ}52'N$, $113^{\circ}59'W$) near Missoula and in the Mission Mountains ($47^{\circ}22'N$, $113^{\circ}52'W$) (P. Wright). Two other long-known locations are McDonald Creek ($48^{\circ}40'N$, $113^{\circ}52'W$) in Glacier National Park (Kuchel 1977) and Kootenai Falls ($48^{\circ}26'N$, $115^{\circ}47'W$) west of Libby.

Harlequin ducks are almost never seen in Montana between October and February. Occasionally a single individual will be seen along the Clark Fork, Kootenai or Flathead rivers in winter. One male was seen at Fort Peck Reservoir on March 18, 1984 - apparently overflying his destination by over 400 miles.

Current

Surveys between 1987 and 1992 evaluated over 160 streams and have identified nearly all of the breeding areas. Solicitations for sightings (posters, newsletters) have identified 2 more areas. Harlequins have been recently documented on 38 streams and rivers in western Montana ($44^{\circ}34'N$, $112^{\circ}15'W$ north and west to $49^{\circ}00'N$, $112^{\circ}15'$ and $49^{\circ}00'N$, $116^{\circ}00'W$) and south-central Montana ($44^{\circ}34'N$, $112^{\circ}15'W$ north and east from the Wyoming border to $45^{\circ}50'N$, $109^{\circ}57'W$ and $45^{\circ}27'N$, $107^{\circ}43'W$). Breeding has been confirmed on 27 streams within both of these areas (Fairman et al. 1989, Miller 1989, Carlson 1990, Fairman and Miller 1990, Gangemi 1991, Lee and Genter 1991, Bergeron et al. 1992). Several streams with known breeding harlequins in the past 15 years have not been occupied since 1989.

POPULATION STATUS

Harlequin ducks are listed as a Species of Special Concern in Montana by the Montana Natural Heritage Program (Genter 1992), and Montana Department of Fish, Wildlife and Parks (Flath 1984). The U.S. Forest Service lists it as a Sensitive Species in Region 1 (Reel et al. 1989). They are placed under Category 2 (C2) status by the U.S. Fish and Wildlife Service (Federal Register 1991).

Breeding population estimates are approximately 110 pairs and associated non-breeders (Genter unpbl. data). Population density (preliminary) ranges from 0.07 - 1.2 pairs/km. Monitoring on 17 streams (from 2-4 years each) suggests a stable or slightly declining population during the period. Of the 5 streams with greater than 4 years of data, 2 have declined 20% or more. One of the largest and best-studied stream populations, McDonald Creek in Glacier National Park, appears to have comparable numbers to the mid 1970's (Kuchel 1977, Ashley 1992).

PRODUCTIVITY

From 1989 to 1992, an average of 41% of observed pairs (range = 19% to 77%; n = 102 pairs on 35 streams) produced broods to fledging. Both of 2 nests found were successful, producing 3 and 4 young each.

Duckling survival to fledging (plumage class I to class III) was 80% for the McDonald Creek population (Kuchel 1977). Duckling survival for the Rocky Mountain Front population was 70% (Diamond and Finnegan 1992). Flooding and prolonged spring runoff was responsible for significantly reduced production, primarily as lower numbers of broods.

MORTALITY AND RETURN RATES

No band returns have been received from 91 birds banded during 1991 (6) and 1992 (85). Although the five adults recaptured from 1991 appeared to be in good condition, one female had holes through the webbing of the feet. We determined that this could only be from shotgun pellets that had passed through the feet. The holes were still perforate but did not appear to be swollen or otherwise indicate a recent injury. Most harlequins leave Montana well before the opening of waterfowl season (early October) and there are just a few anecdotal accounts of hunters taking harlequins along western Montana rivers.

HARVEST

Insignificant within Montana. See above.

MANAGEMENT

Population monitoring is ongoing in tributaries to the lower Clark Fork River and the upper Flathead River drainage. This primarily involves monitoring marked birds for habitat use, movement, dispersal, population recruitment and mortality. A draft management plan will be developed during 1993 in conjunction with

biologists from the U.S. Forest Service and Idaho Fish and Game.

THREATS

Loss of habitat can be attributed to one or more of several factors, including: hydropower development, road building and subdivision, stream degradation from logging or mining, and disturbance from recreational boating, fishing, or wildlife viewing. Streams can become hydraulically unstable due to overharvest of timber in the drainage. This tends to magnify the spring runoff and wash streams out, removing the meandering oxbow features that harlequin ducks require for brood rearing.

Water pollution in coastal habitat, especially oil spills, may have a significant impact on local populations. Increased hunting pressure in coastal waters (Goudie, pers. comm.) will contribute to mortality.

INFORMATION NEEDS

Conduct additional surveys in remote areas and as follow-up on undocumented sightings. This will provide more complete distribution and population estimates. Areas to be further evaluated include: Bitterroot River drainage; wilderness portions of the Flathead River drainage; and the tributaries of the upper Yellowstone River.

Determine the long-term demographic trends and replacement values for maintaining populations. Develop demographic models for determining population viability. This will require coordinated population monitoring between different populations and states.

Assess the impacts of habitat loss from river impoundment, notably the Hungry Horse Dam and Libby Dam. Identify options for mitigating habitat and population losses.

Assess the impacts of human activities on nesting success, especially recreational floating and fishing.

Identify wintering areas for local birds and work with coastal authorities to determine threats and mortality. Assessment of mortality from spills, fishing nets, and hunting is most critical.

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DISTRIBUTION AND STATUS OF THE HARLEQUIN DUCK

(*Histrionicus histrionicus*) IN OREGON

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DISTRIBUTION

Distribution descriptions are based on summaries of Harlequin Duck sightings from the following sources:

- Audubon Field Notes and American Birds 1947-1981
- Northwest Science
- Oregon Birds
- Christmas Bird Count (CBC) data 1947-1991
- museum records
- bird banding data
- contributions from Oregon birdwatchers solicited by word-of-mouth, posters, and news articles.
- posters placed on the Willamette National Forest
- reports of agency personnel from the USFS, ODFW, BLM and USFWS.

Historical Distribution

Limited information on the historical distribution of the Harlequin Duck in Oregon is available. Reports have been gathered from the literature (Townsend 1839; Woodcock 1902; Jewett 1925, 1931; Bent 1925; Gabrielson and Jewett 1940; Audubon Field Notes), museum records (summarized in Bayer 1989), and agency reports.

All descriptions of the historical range of the Harlequin Duck are very generalized but suggest breeding in two disjunct populations in Oregon. One population was reported to breed throughout the Cascade mountains of Oregon and south to northern California. Bent (1925) describes the breeding range as including the mountains of central California, extending north through the Cascades of Oregon and Washington. Gabrielson and Jewett (1940) cite one brood account from the Zigzag River (Clackamas County), then suggest that the species breeds "throughout the Cascades in suitable localities."

A second population of breeding Harlequin Ducks has been reported in the mountains of northeast Oregon. There are several historical records of broods from the Blue-Wallowa-Ochoco mountain system. One nest was found on the upper Wallowa River near Frazier Lake (Jewett 1925), and another on the Imnaha River (Jewett 1931). Oregon Birds (1992; Vol. 18:4) reports that the last verified nesting record of Harlequin Ducks in northeast Oregon was in 1935. Gabrielsen and Jewett (1940) report the species as nesting in the Wallowa's, and the annotated checklist for Union and Wallowa Counties report the species as a rare summer resident in the Wallowa and Blue Mountains.

The distribution of winter populations of Harlequin Ducks is somewhat better documented. Historical reports of wintering ducks report a range that encompasses the entire Oregon coast. In early reports, the bird was listed as rare each year (1898-1900) by the lightkeeper at Yaquina Head (Bayer 1986), and Woodcock (1902) noted their coastal occurrence. Bent (1925) suggests that Harlequin Duck's winter on the Pacific coast as far south as central California. Gabrielson and Jewett (1940) report a similar range, describe the species as "regular and fairly common" in Curry, Lane, Lincoln, and Tillamook counties from August to May, and suggest that with more effort the species will be found in other coastal counties as well. Specimens were collected from Curry, Lane, Lincoln, and Tillamook counties also.

Current Distribution - Breeding Season

Current distribution of Harlequin Ducks in the breeding season is well documented, based on numerous reports by amateur birdwatchers and professional biologists. These reports have been summarized here (Appendices A and B). All recent breeding records come from the Cascade Range in Oregon. There are no records of breeding in the Coast Range - although it is of interest that nesting occurs both along the coast and inland in British Columbia (Breault and Savard 1992), and not far inland on the Olympic Peninsula (Schirato and Sharpe 1992). With the exception of river systems south and east of Mt. Hood, there are no recent records of Harlequins breeding on the east side of the Cascades, and the species apparently no longer breeds in the mountains of the northeast.

Recent reports of Harlequin Ducks in the breeding season suggest that the breeding range extends from the Columbia River south to the Middle Fork of the Willamette River ($43^{\circ} 37'$; Lane County), and perhaps rarely as far south as the North Umpqua River system ($43^{\circ} 15'$; Douglas County). The western boundary of the breeding range runs from approximately $122^{\circ} 10'$ in the north to $122^{\circ} 37'$ in the south, while the eastern boundary would essentially follow the Cascade ridge (approximately $121^{\circ} 20'$ in the north to $122^{\circ} 07'$ in the south).

There have been very few recent sightings of Harlequin Ducks in northeast Oregon. Since 1970 only six confirmed sightings have been recorded from this area (Oregon Birds 18:4). These sightings have all been in April or May, suggesting the possibility that these sightings are of ducks on migration to breeding areas further inland. There is no evidence that Harlequins continue to breed in the Blue, Wallowa, or Ochoco mountains. The possibility does though merit further attention (see "Information Needs" section).

I have located only five records of nests found in Oregon, and these are detailed (where possible) below:

1. One nest was found on the Salmon Rv near Wemme, Clackamas County (Marshall et al. 1992). I have no details on this site.

2. Gabrielson and Jewett (1940) report of a nest with six eggs found on May 31, 1931 on the Zigzag River above the Rhododendron Post Office (Clackamas County). This nest was located in debris on an overturned stump of Oregon alder which had been washed out into midstream during a flood. These eggs were collected and represent the first Harlequin Duck eggs collected in the state.

3. The Oregon Natural History Database reports a nest found in 1971 on the West Fork of the Hood River, 1.5 miles southwest of Lake Branch Creek (Hood River County). It was found in "deciduous vegetation with some cedar along a cold, fast-moving stream adjacent to rimrock, boulder habitat."

4. A nest with seven eggs was found by Larry Gangle (pers. comm.) in 1985 located on a steep rocky slope with a south aspect above the North Fork of the Middle Fork of the Willamette River (Lane County). The nest was found at the base of a dead Ceanothus bush (buckbrush) under a slight overhang of sandstone rock, fifteen feet above the river bank. A highway bridge crossed the river about 40 feet downstream, and the roadway itself was estimated to be 100 feet north and probably 30 feet higher.

5. A nest with eight eggs was found in May 1991 on Clear Creek (elevation 1360 ft.), a tributary of the Sandy River, in the Mt. Hood National Forest (Clackamas County). The nest was located in debris on a small bar adjacent to the river and only a short distance from a hiking trail. The forest overstory was of mixed conifers, including western red cedar and Douglas fir. The adjacent understory was mostly vine maple. The nest site was unoccupied in 1992.

Broods have been reported on more than twenty streams, but it is not known if those streams provided nesting habitat, or if nesting took place on nearby tributaries. A number of authors have suggested that brood rearing areas do not correspond to nesting locations (Wallen 1987; Cassirer and Groves 1989; 1991), and that broods move downstream from nesting areas.

Brood reports have come from the Sandy River system (Clackamas County), including Clear Creek; the Zigzag River system (Clackamas County), particularly Still Creek; the Hood River system (Hood River County), particularly the West Fork of the Hood River, but also Lake Branch Creek; the Table Rock Fork of the Molalla River (Clackamas County); the Breitenbush River drainage (Marion County); the North Santiam River (Marion County); the McKenzie River system (Lane County), particularly the Blue River, but also Lookout Creek and Smith/Browder Creek; and the Willamette River system (Lane County), particularly Fall Creek, Salt Creek, and Salmon Creek, but also Wall Creek and S. Windberry Creek. There has been one brood report from a lake, that coming from Big Lake near Santiam Pass (Linn County) in the high Cascades.

Pairs of Harlequin Ducks have been observed on several other streams during the breeding season (June-August) and these streams should thus be considered as possible breeding habitat. These streams include the Clackamas River system (Clackamas County), especially Fish Creek and Wash Creek; the Collawash River system (Clackamas County); the White River system (Wasco County), which is the only potential breeding habitat identified on the east slope of the Cascades; and the Umpqua River system in Douglas County at the extreme southern end of

the range. In addition, there is one summer report of a bird as far south as Klamath Falls (Klamath County).

Nesting habitat for Harlequin Ducks in Oregon has not been adequately described. Habitat characteristics can not be quantified because of small sample sizes for nest locations, and a lack of knowledge regarding the relationship between nesting and brood rearing areas. In general though, birds sighted in the breeding season are found in habitat similar to that described from other sites in western North America (Cassirer and Groves 1989, 1991; Wallen and Groves 1989; Schirato and Sharpe 1992; Genter 1992; Wallen 1987, 1992).

Breeding ducks appear to require 1) clean, fast-flowing water; 2) nearby loafing sites; 3) dense shrub and/or timber on the banks; and 4) undisturbed drainages. Stream morphology was the primary predictive factor in Harlequin Duck habitat use on the Olympic Peninsula (Schirato and Sharpe 1992). Ducks selected for stream sections with a gradient of 1% - 7%, avoiding low gradient, meandering stream channels and steep headwater areas. Broods appeared to prefer low gradient streams in Idaho (Cassirer and Groves 1990, Wallen and Groves 1989), drainages with a 2% - 3% gradient in Montana (Genter 1992), and gradients of 2% or less in Grand Teton National Park (Wallen 1987, 1992). The positive association between Harlequin Ducks and clear, clean, swiftly moving streams is thought to reflect the abundance of benthic macroinvertebrates (Cassirer and Groves 1989, Schirato and Sharp 1992).

Nearby loafing sites are cited as an important habitat characteristic in all studies (Cassirer and Groves 1991; Wallen 1987, 1992). Loafing sites are often exposed rocks, logs, or root wads. In some stream systems braided channels appear to help provide mid-stream bars as loafing sites (Genter 1992, Wallen 1987).

Dense timber, shrubs, or a mosaic of timber and shrubs are often associated with Harlequin breeding habitat. Genter (1992) found Harlequins inhabiting undeveloped drainages with dense vegetation within the riparian zone, and Cassirer and Groves (1990) found 90% of all broods were near mature or old growth stands. In Grand Teton National Park ducks were associated with shrub vegetation along the banks. Perhaps correlated with remote, undeveloped stream habitat is a negative association between Harlequin Ducks and human activity. Several studies have pointed to the need for an absence of human disturbance (Cassirer and Groves 1989) in Harlequin Duck breeding habitat, or observed an adverse impact of human activities on nesting ducks (Wallen 1987, Genter 1992). In contrast however, Schirato and Sharpe (1992) found no selection for specific timber stand characteristics, and over 90% of pairs observed were found within 300 meters of roads, residences, campgrounds, or trails. Broods and nests recently reported from Oregon are also often in the proximity of roads or trails, but this pattern may only reflect the increased frequency of observers, and not necessarily the increased frequency of the duck in these areas.

Broods reportedly remain near nesting areas for the first few weeks after hatching, and then move downstream (Wallen 1987, Cassirer and Groves 1989). Broods seem to prefer lower gradient streams with slower flows, overhanging vegetation, and plentiful woody debris (Cassirer and Groves 1991).

Most stream reaches used by Harlequin Ducks are on public land; primarily U.S. Forest Service Lands (Willamette National Forest and Mt. Hood National Forest) and some lands managed by the Bureau of Land Management.

Current Distribution - Non-breeding Season

Current winter distribution is generally well-documented based on anecdotal accounts and some survey efforts. The best place for winter birds on the coast is reported to be the mouth of Ten Mile Creek, Lane County (Roy Lowe, USFWS, Off-shore Islands NWR) where up to 42 birds have been observed. Other major winter concentrations of Harlequin Ducks on the coast include Seal Rock and Yaquina Bay (Lincoln Co.), and Tillamook Bay (Tillamook Co.). Reports also come from Coos Bay (Coos County), Gold Beach and Port Orford (Curry County), Heceta Head and Squaw Beach (Lane County), and Netarts and Garibaldi (Tillamook County).

Winter habitat has not been characterized in Oregon, but is known to include boulder strewn shores and points, and kelp beds (Gaines and Fitzner 1987, Breault and Savard 1991, Schirato and Sharpe 1992). Most wintering harlequins occur within 50 meters of shore (Gaines and Fitzner 1987). Most of the prey of the Harlequin Duck during the winter was found to be associated with these rocky areas, and included snails, limpets, crabs, and chitons (Gaines and Fitzner 1987).

Current Distribution - Migration

The annual movement of ducks can be summarized from distribution records. Ducks appear to arrive in the breeding areas in late-April, though there are some early dates for Harlequins in the Cascades in late-February and March. Nests are reported in May and early-June, with broods reported as early as June 2 and throughout the summer. Late reports of individual ducks in the Cascades are from August and September.

Male Harlequin Ducks apparently leave breeding areas in Idaho shortly after incubation commences (Cassirer and Groves 1991). This is apparently true in the Cascades as well. There has been only one report of a male accompanying a brood in Oregon, suggesting that males do leave brood rearing to the females. It is unclear whether males that leave the nesting areas remain in nearby mountain streams or immediately return to coastal areas. Ducks are reported throughout the summer in small numbers on the coast, but these may also be non-breeders who never left the wintering areas.

Ducks appear to arrive on the coast as early as August (Gabrielson and Jewett 1940), but other reports suggest that large numbers don't appear until at least late-November, and often not until late-December. Only in years with early and severe cold spells are appreciable numbers of ducks reported earlier (L. Gangle, pers. comm.) This contrasts with the pattern observed by Schirato and Sharpe (1992), who found the highest concentration of Harlequin Ducks on the coast in the area of the San Juan Islands, Strait of Juan de Fuca, and the outer Washington coast in September. This was followed by a 70% - 81% decline in the total number of birds by February. They noted a significant shifting of birds throughout the winter and between years.

It is thought that wintering ducks return to breeding areas by following streams from the coast to the Cascades. This pattern suggests that wintering and breeding populations of Harlequin Ducks in Oregon are the same. We have no data to support this possibility. Winter populations may also be augmented by long distance migrants from the Rocky Mountains.

POPULATION STATUS

The breeding population of this species is considered sensitive by the State of Oregon and the U.S. Forest Service. Migrant and wintering birds are excluded from this designation.

The most recent estimate of population size is that of Bellrose (1976) and repeated in Marshall et al. (1992). They estimate a breeding population of 100 pairs of Harlequin Ducks in Oregon. Based on my experience on the Willamette National Forest, which covers approximately one half of the current breeding range in Oregon, I suspect there are far fewer than 100 breeding pairs in the state. Despite our surveys and a fairly prominent effort to solicit Harlequin Duck sightings from field biologists and the public, we gathered only ten reports of pairs of ducks and only eight brood sightings. The Harlequin Duck appears to have been extirpated from the Wallowa Mountains where breeding was previously confirmed. The duck also may have been extirpated from the southern Cascades where it has been widely assumed to breed. I believe there are less than fifty breeding pairs of Harlequin Ducks in the state. Much more work, however, needs to be done to gain an accurate population estimate.

Winter Harlequin populations have not been quantified and no survey currently provides sufficient data to assess population trends. Population indices from the Midwinter Waterfowl Survey flown in January of each year obtained from J.C. Bartonek (USFWS) located only 0-21 Harlequin Ducks annually from 1955-1991. These surveys of coastal areas tend though to focus on estuarine habitats and so offer very little good information on Harlequin Duck numbers. Christmas bird counts annually locate a number of Harlequins, and counts are held in several locations which are frequently mentioned as some of the best locations for Harlequins on the Oregon coast (ie. Tillamook and Yaquina Bay). Counts at these locations have yielded an average of 15 and 5 ducks respectively (see Appendix C). Christmas Bird Count data have not been analyzed for trends, but sample sizes are small and no obvious trend is evident. These data do suggest though that the number of ducks wintering on the Oregon coast may be quite small - perhaps less than 200.

PRODUCTIVITY

No studies of Harlequin Duck productivity have been undertaken in the Oregon Cascades. From data presented here, the average clutch size for only three nests is 7 eggs, and the average reported brood size is 3.6 ($n = 23$). We have no data on survival of chicks or recruitment into the breeding population, nor have any multi-year studies been conducted to study annual variation in productivity.

MORTALITY AND RETURN RATES

The Bird Banding Lab reports (August 1992) no record of any ducks banded or ever recovered in Oregon. They have only 8 recovery records - two from Alaska, and six from Wyoming. All the birds banded to date have been from Alaska, Wyoming, Idaho, Montana and Washington.

A first-year male bird with a metal band was reported at Yaquina Bay (R. Lowe, pers. comm.), but the duck was not captured and attempts to establish its origin were unsuccessful.

HARVEST

Oregon regulations permit hunting of Harlequin Ducks. The species is included in the regular waterfowl season and no additional restrictions or limitations apply. The waterfowl season in Oregon opens October 10 and extends through January 10 with various zones open for only a portion of that time. The regular season harvest limit is four ducks per day.

Numbers of Harlequins taken by hunters is unavailable but probably quite low (B. Bayles, ODFW). Hunters are not required to report the number of Harlequins harvested. J.C. Bartonek (USFWS) has summarized returns of duck wings used in the Waterfowl Parts Collection Survey, including the number of wings submitted from Harlequin Ducks. Wings were returned from nearly 580,000 ducks in the Pacific Flyway from 1961-1991; only three of those were from Harlequin's, and none were returned from Oregon. Harlequin's are probably under-represented in this survey though because their distinctive plumage makes them more likely to be mounted rather than submitted to the survey.

MANAGEMENT

There are no population monitoring procedures currently in use in Oregon.

There are presently no published guidelines for management of Harlequin Duck habitat in Oregon.

The Willamette National Forest has been designated the lead forest for development of Harlequin Duck management guidelines in Region 6 of the US Forest Service. A standard survey protocol has been developed and has been used on the Willamette for one season. In 1992 Forest Service biologists, ODFW biologists, and Lane County Audubon volunteers surveyed 188 miles of 40 streams on the Forest for the presence of Harlequin Ducks. These surveys yielded only three sightings. Surveys have also been conducted for two years by Steve Dowlan in the Clackamas and Santiam Resource Areas of the Bureau of Land Management. Stream survey data from 1991 are not available, but in 1992, 11 miles of two streams were surveyed. These efforts have yielded few data on nest site characteristics, but have begun to describe brood rearing habitat, and provide basic information on centers of Harlequin Duck activity. These surveys should form the basis of a concerted, coordinated survey and monitoring effort to locate and characterize nesting and brood rearing habitat at several of these activity centers. It would appear that a significant cooperative effort should be undertaken by resource agencies to accurately describe

Harlequin Duck habitat and population dynamics in the Oregon Cascades in order to formulate management guidelines in Oregon (see "Information Needs" section). Until then, management will have to be based on possibly inappropriate studies from outside the region.

THREATS

Based on what is currently known of the biology of the Harlequin Duck, potential threats to the breeding population in the Oregon Cascades include logging, the reduction of streamside buffers and the potential loss of woody debris input to streams; road construction or other activities that may increase sedimentation and have adverse impacts on aquatic macroinvertebrates; and fishing, rafting, or other recreational activities that disrupt breeding birds. Many of these threats occur singly or in combination in most of the drainages with Harlequin Duck reports.

Possible threats on the coastal wintering areas include the risk of oil spills or other pollution reaching shoreline areas, beach and/or shoreline developments, and human disturbance. The impact of hunting on the duck population should be investigated.

INFORMATION NEEDS

1. More work should be done to accurately define the breeding range of Harlequin Ducks in Oregon. Particular attention should be paid to streams in the Blue-Wallowa-Ochoco mountain system since breeding has been confirmed there in the past and these birds represent an isolated population. Surveys should also be undertaken in the southern Cascades.
2. Design and implement studies to characterize productivity and habitat use by breeding individuals. Utilize previous studies on the Willamette National Forest and the Clackamas Resource Area (BLM) to locate activity centers and define nest site and brood rearing habitat characteristics. Assess potential factors affecting breeding habitat, including adjacent land uses, recreational use of the stream, stream flow rates, stream gradient, invertebrate densities, and loafing sites.
3. Establish a statistically valid statewide monitoring plan for the breeding population. Rebecca Goggens of the Oregon Dept. of Fish and Wildlife has volunteered to assist in this effort.
4. Conduct immediate surveys to determine the size and distribution of wintering populations in Oregon. Establish a similar monitoring plan for the winter population.
5. Determine the origin of winter populations of the Harlequin Duck. Is the winter population the same as our breeding population, or is it augmented by other migrants?
6. What impact does hunting have on the winter and breeding population of Harlequin Ducks in Oregon?

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A PRELIMINARY STATUS REPORT OF HARLEQUIN DUCKS IN WASHINGTON 1993

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DISTRIBUTION

Historical

A search of 48 museum's records and interviews conducted by Crouch (1969) revealed 86 historical harlequin observations on a total of 36 streams. All observations occurred from 1918-1969. Other observations for this period are noted by Yocum (1951), Jewett (1953), and Lafave (1955). From 1970-1985 the Washington Department of Game, Nongame Data System (NDS) (1987) indicates 85 harlequin observations for a total of 48 streams with harlequins. Kitchen (1939) stated that harlequins nested sparingly on mountain streams within Mt. Rainier National Park. The historical records span the entire state. Most of the records are from the eastern slopes of the Cascades, with additional records from the Okanagon Highlands, Blue Mountains, Olympic Mountains and one record from the Northeast corner of the state.

Historical concentrations of harlequin ducks on saltwater locations from the 1800's were summarized by Miller et al (1935). The birds were noted in the San Juan Islands throughout summer and winter. Most observations were from June and July and flocks of considerable size were sometimes noted. There are 91 additional records of birds and flocks from the 1970's along the Pacific Ocean at Cape Alava through the Straits of Georgia into Northern Puget Sound (NDS 1987). Harlequin distribution and abundance estimates in the Strait of Juan De Fuca and Northern Puget Sound were conducted by both Fleishner (1983) and Hirsch (1980). The wintering distribution of harlequins in Washington has been fairly well elucidated.

Current

Current breeding distribution has been fairly well documented but some gaps exist. Surveys of over 1000 km. of streams and a poster solicitation have been conducted by the Washington Department of Wildlife (Washington Department of Wildlife unpublished data) for a total of 118 streams with harlequins during the breeding season. The current distribution follows the historic distribution. All historic streams surveyed still have harlequins. However, the Blue Mountains of Southeastern Washington have received little survey effort. In most cases the harlequins appear in the same location on the system as they were historically noted.

Harlequins arrive on the streams at the end of March and beginning of April. Several times large flocks of paired harlequins were observed at the mouth or lower section of the river during Spring arrival. Nesting is initiated mid-April-June.

Breeding stream stretches used by harlequins are swift moving forested areas with 1-7% gradients. No particular pattern of forest stand characteristics can be associated with the harlequin pair observations (Schirato 1992). The land ownership is primarily U.S. Forest Service and National Park Service. However, a considerable number of harlequins occur on private lands.

Harlequins are observed on the saltwater throughout the entire year. Peak numbers occur before breeding in March (Fleischner 1983) and after breeding in late September. Numbers decrease approximately 73% by the end of January and February (Schirato and U.S.F.W.S. unpublished data). Wintering birds feed on snails, limpets, crabs and chitons. Nearshore areas associated with cobble and cobble/rock substrates are the primary utilized habitat followed by seaweed areas (Gaines and Fitzner 1987). The land ownerships in the wintering areas is comprised mainly of U.S. Fish & Wildlife Service, and private ownership.

POPULATION STATUS

Only on the Olympic Peninsula have harlequin density and total pair numbers been more intensively monitored. Based on single stream surveys a minimum population of 152 pairs is estimated. Densities ranged from .01-1.6 pairs/km. Based on observations alone throughout the remainder of the state the minimum population estimate is 274 pairs (WDW unpublished data). The stability of the breeding population is unknown.

The wintering populations have been surveyed by fixed-wing and boat utilizing shoreline and open water transects. The northern Puget Sound populations have been estimated to be 909 (Hirsch 1980), 0 (Wick and Jefferey 1966), and 150 (Fleishman 1983). The total early fall population in 1991 was estimated to be 1356 birds (Schirato 1992).

PRODUCTIVITY

In Washington no historical information is available about productivity. Interviews with egg and bird collectors does give insight into nesting site selection. Collectors have observed about 41 nests. Approximately 90% of the nests occurred on mid channel islands. Many of the nest sites on the islands had nests in successive years of visitation. Predation on eggs was noted by both river otters and black bears (Jeff Foster, Pt. Defiance Zoo unpublished data). However, the total number of birds producing young is unknown. The average brood sizes in Washington for 1991 and 1992 successively has been 4.4 (N=35), and 3.3 (N=24) (Schirato unpublished data).

MORTALITY AND RETURN RATES

There have been no returns of 12 harlequins banded and radio tagged in 1992. In 1992, an incubating female was observed being attacked by a goshawk during an incubation break. The female did not return to the nest (Phil Scholfield, National Geographic Society, per. comm.)

HARVEST

Harlequin hunting is open for a four bird/day bag limit throughout the migratory waterfowl season, of approximately 59 days. None the less, few harlequins have ever been checked or reported in the bag of waterfowl hunters. U.S. Fish & Wildlife Special Agents have reported checking a few birds in the past from Indian Island, Wa. Overall there is little to no harlequin harvest.

Collection permits for harlequins have been issued to various breeders and zoos. Not all past collection permits are catalogued. In 1992, a permit was issued for the collection of 15 juvenile birds. In the late 1970's 24 birds/year were collected on the western shore of San Juan Island and Battleship Island. Prior to this a permit was issued for the collection of 50 harlequins at Protection Island. This was an unsuccessful collection attempt. The total extent of collecting is unknown.

MANAGEMENT

The harlequin is a Priority Habitat Species (PHS) in Washington. All harlequin locations are entered into a GIS data base. The GIS locations are then cross referenced for all forest practice applications and made available to county land use planners. When an application is in the vicinity of a harlequin location a site consultation with a habitat biologist and conditioning of the permit may occur. Guidelines for harlequin habitat protection have been distributed to land owners and planners by the Washington Department of Wildlife.

THREATS

Logging, water recreation, irrigation diversions, and hydroelectric developments could all potentially threaten the harlequin habitat. On the Methow River, with heavy recreational rafting, a decline in harlequin usage has been noted (G. Erady, WDW, unpublished data). Dams on the Elwha River have eliminated some high density harlequin habitat. Finally, the role of logging is unknown.

On the saltwater areas oil spills and shoreline development are the more proximate threats. The wintering birds concentrate at specific points and spits where they would be vulnerable to oil spills. In 1991, approximately 10% of the wintering birds were threatened by the Tenyu Maru oil spill.

INFORMATION NEEDS

Additional surveys are needed to determine the distribution and total pairs in the Cascades and Blue Mountains.

The extent of interchange in the coastal populations needs to be determined. In 1992, 10 harlequin ducks were radio tagged. These birds were not found in the flocks at the mouths of the rivers in

which they were tagged. Additionally, they were not present in the major flocks utilizing Puget Sound.

Survival and recruitment rates into the population need to be determined.

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HARLEQUIN DUCK STATUS REPORT 1992

WYOMING

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DISTRIBUTION

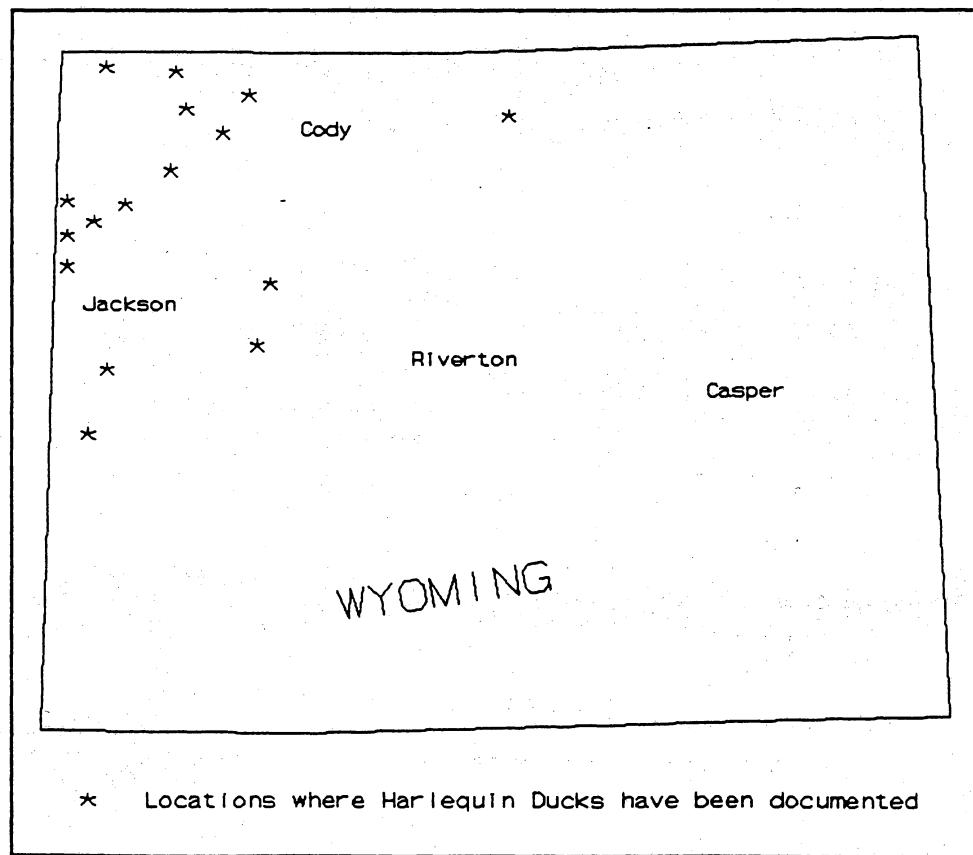
Historical

Information regarding the historical distribution of harlequin ducks is very limited and found primarily in wildlife observation system databases for Grand Teton (GRTE) and Yellowstone (YELL) National Parks, Wyoming Game and Fish Department (WGFD) and The Nature Conservancy (TNC). A few additional observations can be found in journals of early explorers and outfitters (Palmer 1913, McCreary 1937). Prior to 1980, harlequins were considered rare residents to the northwestern portion of the state (Harju 1980). No substantial information exists that indicate what the historical distribution was and how many individuals were present.

Current

The current status of information regarding distribution in Wyoming is slightly better than historical accounts. Systematic surveys have never been performed throughout most of the known range to evaluate potential habitat for occupancy by harlequin ducks. Compilation of observations indicate that the species is restricted to the northwestern portion of Wyoming (Fig. 1).

Fig. 1.
Locations
throughout
Wyoming where
observations of
harlequin ducks
have been
documented.



Harlequin duck habitat in Wyoming is characterized as remote (accessible by humans via backcountry trails). Very few locations are accessible by vehicle and these sites are primarily used during times of migration. The typical adjacent plant community consists of tall shrubs or old growth forest. Aquatic invertebrates have not been quantified but qualitative sampling indicates they are characteristic of highly productive streams with high water quality values (Wallen 1987).

The distribution of occupied habitat is well known within the two national Parks, Grand Teton and Yellowstone (Wallen 1987, Wallen 1991, McNeany pers. comm.). The number of streams with current confirmed breeding information include 5 in GRTE, 4 in YELL, 2 on the Targhee N.F. and 1 on the Shoshone N.F. Observations of harlequins have been recorded for the Bridger Teton and Big Horn National Forests but no confirmed breeding documentation exist for these later administrative units.

Harlequins begin arriving annually to northern YELL in late April and in GRTE in early to mid May depending on the spring thaw. Some individuals remain in Wyoming until mid to late September. Two observations of harlequins have been recorded along the Yellowstone river during February (1) and March (1) (Wallen 1987). Observations of birds that were color marked for individual recognition indicate that Harlequins migrate from YELL through northern Idaho to Washington to winter (Fig. 2).

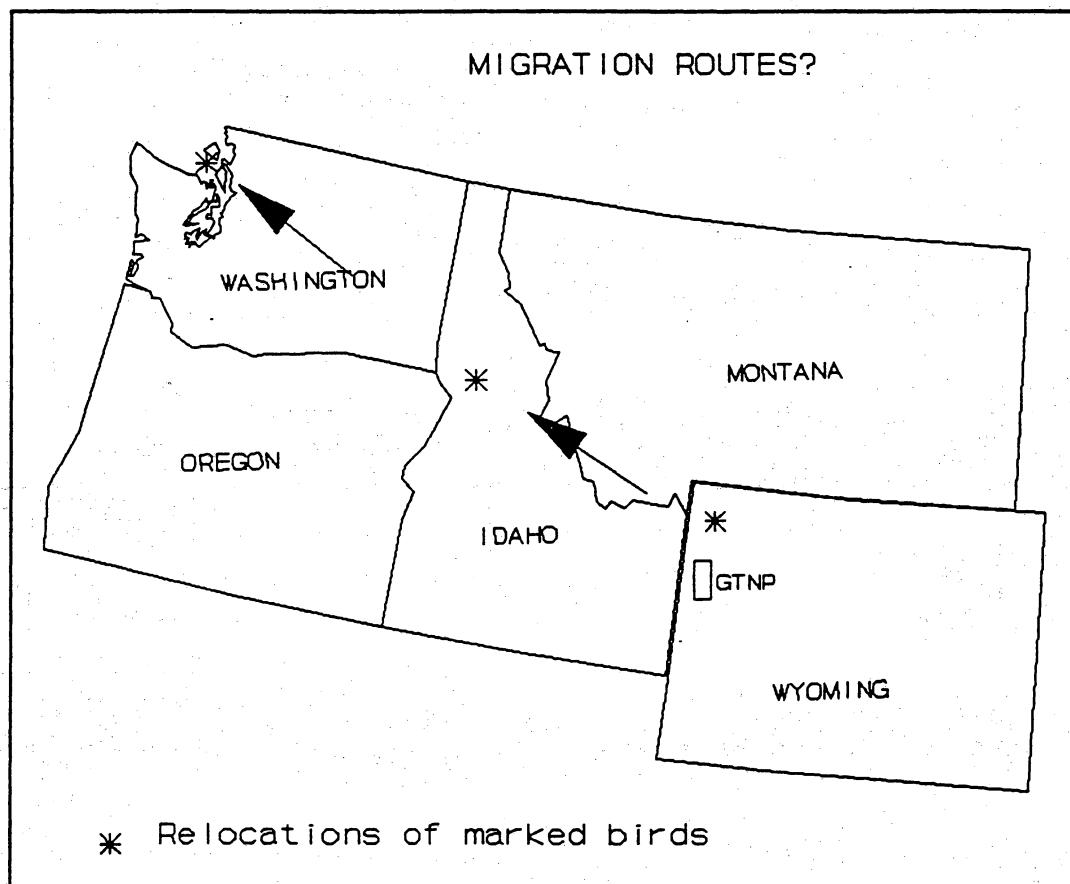


Fig. 2. Potential migration route utilized by harlequin ducks for traveling to and from Wyoming.

POPULATION STATUS

The southeastern perimeter of the range for the Pacific population of harlequin ducks extends into Wyoming. Clark et al. (1989) identified harlequins among those species that are in need of field survey work to determine population status, distribution and habitat use throughout the Greater Yellowstone Area. In YELL and GRTE the species is found to breed only in areas away from human developments (Wallen 1987, YELL wildlife observation files). Only three of the six federal land management agencies where documented observations occur have performed any field surveys to determine the status of harlequins and GRTE and Yell are the only administrative units where systematic surveys are complete. With such limited information it is impossible to make any kind of statewide estimate of abundance and or status. The state and federal agencies in Wyoming that are involved with conservation of harlequin ducks have differing status designations

National Park Service	species preservation
U. S. Fish and Wildlife Service	Category 2 candidate
U. S. Forest Service	Sensitive species
Wyoming Game and Fish	Game species

Research and monitoring activities have been carried out in GRTE since 1985 (Wallen 1991). Systematic surveys for harlequins began in 1987 in YELL (McEneaney pers. comm.). The number of adult birds fluctuate annually with the general trend being that drakes outnumber hens by as much as 100% (Wallen 1991). Four stream locations in GRTE are censused annually to determine the total number of adults (Fig. 3). Pairs are probably the best parameter to monitor the well being of the local adult segment of the sub-population. A mean of 10 pairs per year have been observed on the four monitoring streams. (range= 7 - 13 pairs)

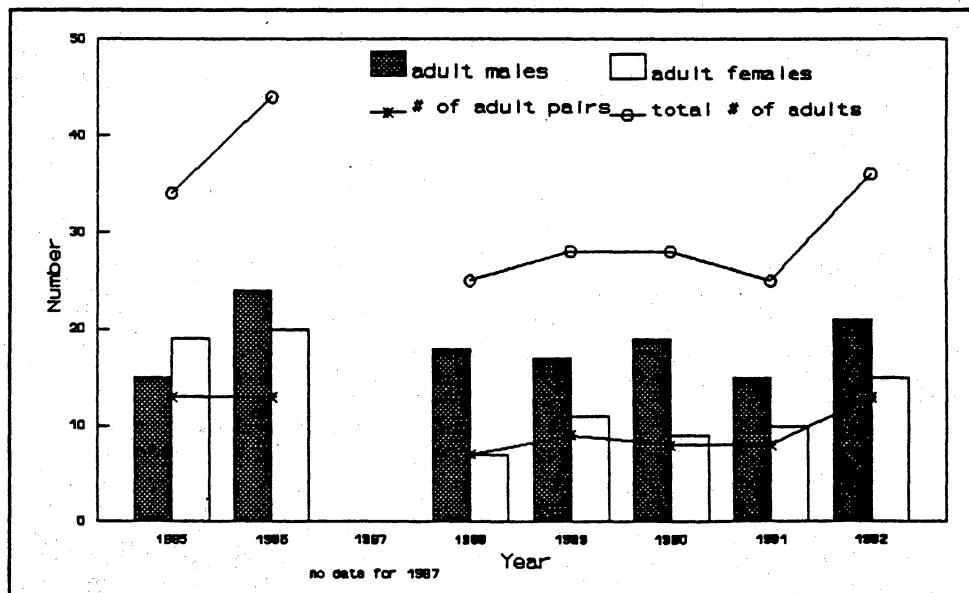


Fig. 3. Annual number of adults and pairs identified in censuses performed in Grand Teton National Park.

PRODUCTIVITY

Productivity data for harlequin ducks in Wyoming is available only for the administrative boundaries of Grand Teton National Park. Approximately 14 km. of backcountry stream habitat has been monitored annually since 1985 for productivity data. The mean number of young produced in GRTE annually is 22.75 (n=8) with the range being from 4 to 36 (Fig. 4). The long term mean number of ducklings per brood is quite variable and appears to be influenced by human activities, spring runoff, and habitat modifications (Fig. 5, Wallen 1991).

Fig. 4. Brood production and number of young produced/year in Grand Teton National Park.

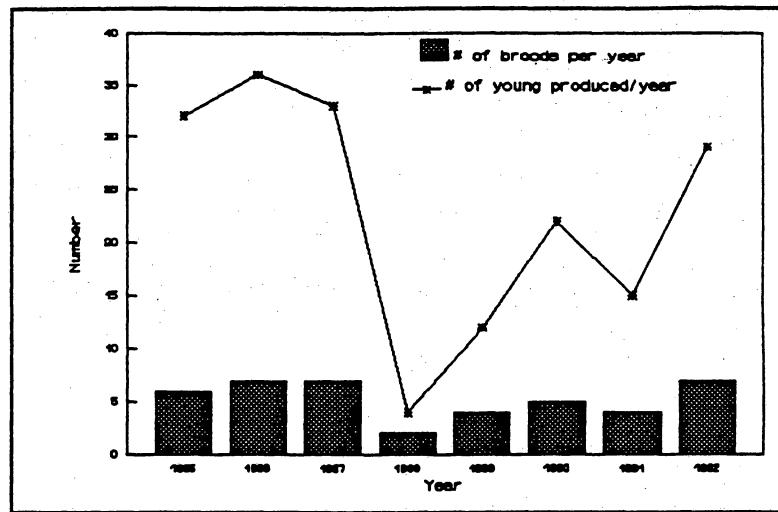
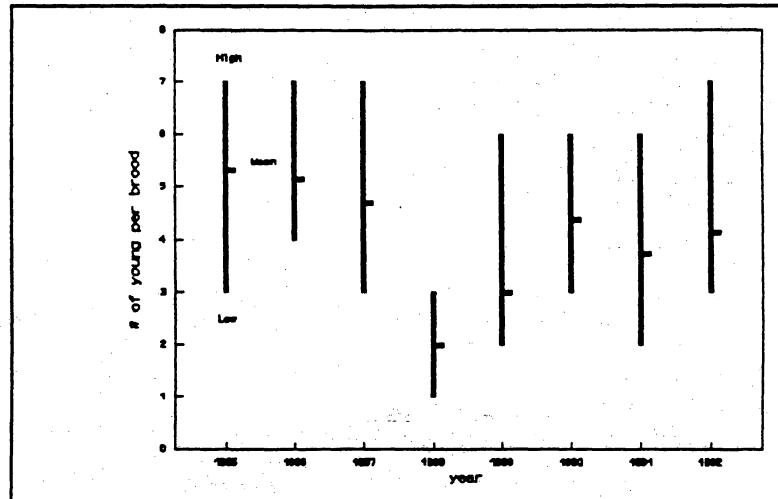


Fig. 5. Annual mean brood size and range of ducklings/brood in Grand Teton National Park.



MORTALITY AND RETURN RATES

Details about mortality rates and probable predators are purely speculative. Mink (Mustela vison), river otter (Lutra canadensis), peregrine falcons (Falco peregrinus), northern goshawk (Accipiter gentilis) and bald eagles (Haliaeetus

Fifty four adult birds have been fitted with nylon nasal markers (Lokemoen and Sharpe 1985) for individual recognition. The mean return rate of marked birds between 1986 and 1991 was 40% (range = 23 - 52%).

Most hens return to breed along the same stream sections for 2-4 consecutive years. Natal philopatry of females is high in the Teton Range as well as in Iceland (Wallen 1991, Bengtsen 1966). Generation time is generally 2-3 years with hens returning to virtually the same sites they were banded as juveniles. The oldest known individual was a female banded as a hatch year bird in 1985 and recaptured in 1991.

HARVEST DATA

No collecting permits have ever been issued in Wyoming. Only two documented accounts could be located regarding birds that were harvested (Palmer 1913, Cottam 1939).

MANAGEMENT

Virtually no management actions are taken with regard to preservation of harlequin ducks in Wyoming. Fortunately, most of the suitable habitat within the occupied range of the species is located within National Parks and wilderness areas. Quantitative monitoring of adults and brood production occurs annually within GRTE along four study streams (Wallen 1991).

THREATS

Threats to harlequins in Wyoming appear to be minimal within the areas that have recently been surveyed. Recreational activities of humans are the largest concern. In the National Parks, fishing activities are of utmost concern. However, additional surveys throughout northwest Wyoming may provide more data regarding threats. Mining near Cooke City, Montana has the potential to pollute an important stream utilized by harlequins in YELL. Paving of a formerly remote road through the Sunlight Basin on the Shoshone N. F. could also lead to increased human activities in an area where surveys have not been completed.

INFORMATION NEEDS

The greatest need for Wyoming is to perform surveys to more precisely determine the streams currently utilized by harlequin ducks. Range maps for this species generally covers much of the northwestern portion of Wyoming (Bellrose 1980, Palmer 1976, Todd 1979). Thus, areas throughout northwestern Wyoming outside the two National Parks would be the highest priority for surveys. The perimeter of the total survey area should be considered the Montana and Idaho borders south to the headwaters of the Salt and Grays rivers on the BTNF, northeasterly through the Wyoming Range and along the east front of the Wind River Range and the Absaroka Range but including the Shell canyon area of the Big Horn National Forest. During the course of a thorough survey effort, evaluation of local land management practices should be accomplished with recommendations for monitoring frequency to determine impacts on harlequins.

Since harlequins spend less than 4 months of the year in Wyoming, studies need to be initiated to determine migratory movements, stopover areas and location of winter range for birds that summer in Wyoming. Satellite telemetry technology is currently not available for species as small as the harlequin duck. However, the use of this technology when it becomes available may be

the only way to gain this much needed information.

An effort also needs to be made to determine whether harlequins that winter on the Pacific Ocean are in fact only one population. The study of gene loci via collected blood samples could provide some clues to the sub-population puzzle.

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HARLEQUIN DUCK STATUS REPORT 1992
MAINE

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DISTRIBUTION

Historical

Limited historical information has been published on wintering harlequin ducks in Maine (summarized in Mittelhauser 1991). Hebard (1959), Hundley (1988), Jenney (1908), Norton (1896), and Palmer (1949) list sight records for coastal Maine in the Isle au Haut area ($44^{\circ}09'N$ $68^{\circ}22'W$ to $43^{\circ}51'N$ $69^{\circ}09'W$). Norton (1896), Knight (1897, 1908) and Palmer (1949) characterized them as formerly (pre-1895) common along the Maine coast in winter (extent of this range unknown) but noted steady declines in numbers and distribution.

Vickery (1988) published numbers from Isle au Haut and adjacent islands as a result of 5 censuses from 1976 to 1984. His results show the Isle au Haut area harbors the largest wintering population in eastern North America.

Harlequins ducks have never been recorded as breeding in Maine (Palmer 1949, 1975).

No historical information exists on migration routes. It is assumed that the birds in Maine breed from Gaspe Peninsula north to Labrador (Palmer 1975) although this has not been proven.

Current

Current wintering distribution is well documented for the Isle au Haut area ($44^{\circ}08'N$ $68^{\circ}19'W$ to $44^{\circ}00'N$ $68^{\circ}54'W$) based on 15 boat surveys (Mittelhauser 1991, 1992), limited documentation from York to Georgetown ($43^{\circ}50'N$ $69^{\circ}40'W$ to $43^{\circ}10'N$ $70^{\circ}35'W$) where small but consistent numbers are found on Christmas Bird Counts, and nearly undocumented in the remaining coastal areas. Other significant wintering areas may exist in this undocumented area. Most areas where harlequin ducks were historically noted are currently occupied although not all of the historical wintering areas have been checked.

Wintering areas are nearly all isolated surf-beaten rocky islands, ledges, and headlands with steep shores. Relatively little human use of these areas occurs in winter although scallop draggers, scallop divers, and lobstermen occasionally work adjacent areas. Over 75 percent of the areas used by wintering harlequin ducks (in the Isle au Haut area) are publicly owned or otherwise protected. The south shore of Isle au Haut, an area within Acadia National Park, harbors the largest wintering group (nearly 200 individuals) in Maine and may be the most critical harlequin duck

habitat in the state.

Harlequin ducks are generally present in Maine from October through May although occasional individuals have been recorded on salt water during the summer months (Mittelhauser 1991; unpub. data).

Current invertebrate faunal densities at key wintering areas are not known.

POPULATION STATUS

In 1990 harlequin ducks were classified as an endangered species in eastern Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Harlequin ducks wintering in Maine are considered part of this endangered eastern North American population. A Canadian recovery plan is currently being drafted (Montevecchi et al. 1992).

In Maine harlequin ducks are currently considered a 'species of special concern' and are being nominated for state threatened status in 1993. They have been protected from hunting since 1989.

Wintering densities/kilometer of shoreline have not been calculated but vary from island to island. Seven islands in the Isle au Haut area have been found to harbor the greatest concentration of harlequin ducks (mean > 20 birds based on 10 surveys): The Cow Pens, Great Spoon Island, Isle au Haut, Little Spoon Island, Mason Ledge, Spirit Ledge, and White Horse (Mittelhauser 1991).

Harlequin ducks were once an abundant species along coastal Maine (Norton 1896, Goudie 1989) but declines in numbers were reported in the late 1800's (Norton 1896). Knight (1908) reported '200 individuals would be a very liberal estimate of the numbers which visit our entire Maine coast in winter'. Numbers have not currently rebounded. Vickery (1988) estimated 300 birds along the entire coast of Maine with 200 to 250 individuals in the Isle au Haut area, a result of censuses and analysis of Christmas Bird Counts.

Total wintering population is currently estimated at 500 birds based on censuses of the Isle au Haut area (Mittelhauser 1991, 1992) and other reported numbers (Mittelhauser 1991; unpub. data); 450 birds in the Isle au Haut area and 50 birds in York County and the Portland area. This may not represent an increase from Knight (1908) or Vickery (1988) but rather a result of numerous surveys of the Isle au Haut population and recent interest in this species.

Twenty-two shore based surveys of the Isle au Haut area from 1988 to 1992 revealed significant declines in the population (Mittelhauser 1992) and significant declines are being noted in Canada as well (Montevecchi et al. 1992).

PRODUCTIVITY

No breeding in the state.

MORTALITY AND RETURN RATES

No banding has been conducted in the state.

HARVEST DATA

In Maine harlequin ducks have been protected from hunting since 1989. Few people hunted them although 24 were reportedly shot in 1988 in the Isle au Haut area (B. Allen pers. comm.). Additional birds from the Isle au Haut area were shot in the 1970's (A. Hutchinson pers. comm.).

Illegal harvest is currently considered insignificant. Most harlequins winter far from typical seaduck hunting sites. No collecting permits have been recently issued.

Historically (1800's), hunting mortalities were significant (Norton 1896).

MANAGEMENT

No organized population monitoring is in place in the state except for periodic surveys based on available funds. A state recovery plan will be drafted in 1993 by the Maine Department of Inland Fisheries and Wildlife - Endangered and Threatened Species Group which will establish state goals and objectives and outline management actions.

No habitat guidelines currently exist. Essential habitat will be eligible for protection after the listing of the harlequin duck to endangered in Maine in 1993.

THREATS

- 1) Human disturbance.
- 2) Oil pollution.
- 3) Illegal hunting.
- 4) Habitat degradation from the effects of fishing and seaweed harvesting activities.
- 5) Kleptoparasitism by gulls was identified as a potential problem in 1989 at Isle au Haut (Mittelhauser 1989).

INFORMATION NEEDS

- 1) Develop statistically valid standardized survey techniques and regularly monitor population levels and rates of change.
- 2) Regularly document age and sex ratios to determine reproductive success on the breeding ground.
- 3) Identify additional wintering areas. A small percentage of the offshore coast has been checked for wintering birds.
- 4) Determine origin of the wintering birds in Maine. Do they all breed in Labrador or do birds from Greenland mix in?
- 5) Determine migration and dispersal patterns of wintering populations (within Maine and among other wintering areas).

How long do individuals stay in a particular area? Are some areas more critical than others?

- 6) Determine mortality rates for adults and juveniles.
- 7) Identify staging areas and critical needs while on staging areas.
- 8) Document diet of harlequins and assess populations of historic and current prey species.

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HARLEQUIN DUCK STATUS REPORT 1992

BRITISH COLUMBIA

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DISTRIBUTION

Historical

The species is present on a year-round basis in British Columbia. Harlequin Ducks are fairly to very common along the mainland and Queen Charlotte Islands coasts, and a widespread but uncommon migrant and summer visitant in most of the interior (Campbell et al. 1990).

Nesting habitat includes streams, rivers and marine coastal habitat. A review of published and unpublished literature identified 49 records of unfledged broods (Breault and Savard, 1991) and 4 records of nests (descriptions in Campbell et al. 1990) for British Columbia. Records originated mostly from protected (e.g. parks) and easily accessible areas, and ranged in altitude from sea level to 2175m (Breault and Savard 1991). Available records were distributed over 30 streams and rivers (37 records), 6 lakes (9 records), 6 coastal locations (6 records), and one unspecified inland location.

Outside the breeding season, Harlequin Ducks can be found over the entire B.C. coast, with the largest known concentrations occurring in Georgia Strait (Savard 1988a, b; Campbell et al. 1990; Breault and Savard 1991). However, a few individuals are seen inland in the Okanagan and the West Kootenay during Christmas Bird Counts (CBC). Large concentrations have been reported at herring spawns in Georgia Strait (Dawe, unpubl. data; Chadwick 1992). Adult sex ratios on wintering grounds are biased towards males (Savard 1988a, b, 1989; Campbell et al. 1990; Cahdwick 1992).

Current

Updated information on breeding and nonbreeding distribution and abundance consists almost exclusively of incidental sightings made by naturalists (summarized by Campbell et al. 1990) and of Christmas Bird Count data. Three studies provide some information on the migration and wintering habits of the species. During a one-year study (1979-1980) in the Comox area, adults departed from the Coast from April to June, low numbers of adult remained on the coast throughout July and August, and adult numbers rose again in September (Canadian Wildlife Service (CWS)

unpubl. data). Studies conducted in White Rock in 1980-1981 (Savard 1988a, b, 1989) and 1986-1989 (Savard and Breault unpubl. data) revealed a similar pattern, although large numbers of individuals were observed during molt in August and September.

POPULATION STATUS

British Columbia supports relatively large populations of Harlequin Ducks on a year-round basis. The breeding population has been speculated at 4,000-8,000 pairs (Bellrose 1976), while the wintering population has been estimated at a minimum of 6,000 individuals (Breault and Savard 1991) up to the high 10,000's (Campbell et al. 1990). The species has no special designation in the province, although CWS recommended that Harlequin Ducks be used as an indicator of pristine ecosystems in the Tatshenshini proposed wilderness area.

The only quantitative information on breeding density comes from a helicopter survey conducted in Carbon Creek, northwestern B.C., in May 1977, where 10 pairs were observed over 19.5 km of river (density = 0.51 pairs/km) (Breault and Savard 1991). No data currently exists to analyze size or fluctuations in inland and coastal breeding populations. Coastal nesting has been reported from Alaska, but it is poorly understood.

Analyses of CBC's conducted between 1975 and 1991 in 8 areas of the Strait of Georgia indicate a nonsignificant gradual decline in harlequin duck numbers in 4 areas (i.e. Comox, Nanaimo, Pender Islands and White Rock) and a nonsignificant increase in numbers in Ladner and Victoria. Over the 15-year period, Harlequin Duck numbers decreased significantly in Deep Bay and increased significantly in Vancouver. It is likely that declines in numbers are more significant than suggested from the above data, as the number of observers per area drastically increased over the last 15 years, resulting in better area coverage. Better coverage might explain the increases in the most urbanized areas (i.e. Vancouver, Victoria and Ladner), while masking the extent of the decrease in the more remote areas. No information is available as to the causes of those fluctuations.

PRODUCTIVITY

No information is available on nesting success and nest productivity. No information is available on overwintering and molting mortality factors.

MORTALITY AND RETURN RATES

No bands have been returned from a total of 34 birds (4 females and 30 males) banded between 1978 and 1986. Surveys conducted

between 1986 and 1989 on individuals marked on molting areas indicated that: 1) males and females share molting sites; 2) molting sites are also in some cases used as wintering sites; and 3) adults are philopatric to wintering and molting areas (Savard and Breault, in prep.). The low number of females found molting on the coast in summer are nonbreeders or failed breeders.

HARVEST

Results from the national Harvest Questionnaire Survey suggest insignificant hunting, but this survey is not an effective measure of the hunting effort and harvest on low profile species such as the harlequin duck. No collecting permits are issued for the species.

MANAGEMENT

No population monitoring is in place, and no habitat guidelines exist.

THREATS

Harlequin Ducks may not be subject to high hunting pressure in British Columbia up to recent years (Metras 1985; Dickson 1989). However, liberal seasons and bag limits presently apply to the species, and should the hunting interest change (e.g. expanded sport hunt outfitting such as in Alaska), hunting could become a significant threat.

Outside the breeding season, Harlequin Ducks are gregarious and concentrate at limited locations. The largest known concentrations (e.g. Georgia Strait) occur where toxic pollutants are abundant (Waldichuk 1983) and where commercial, industrial and recreational development of coastal areas would affect abundance and quality of key wintering habitat.

Logging, mining and grazing might affect productivity of harlequin ducks and the number of streams used by breeding individuals. Harlequin Ducks tend to be observed in pristine wild river habitats, and little is known of their use of altered watersheds.

INFORMATION NEEDS

The management of Harlequin Ducks is severely impaired by a lack of understanding of their biology and distribution. Breault and Savard (1991) recommended efforts be invested into: 1) surveys of breeding, molting and wintering populations; 2) protection and monitoring of key molting and wintering areas; and 3) research on

habitat selection, reproductive success, and effects of human disturbance.

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HARLEQUIN DUCK STATUS REPORT EASTERN CANADA

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Presented to the Special Committee on the Status of Harlequin Ducks
in North America, Pacific Seabird Group Meeting,
Seattle, Washington
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Distribution

1. Historical

The three disjunct Atlantic populations of the Harlequin Duck (*Histrionicus histrionicus*) have suffered declines, and have been given special status designation for management purposes and full protection from hunting. Historically, Harlequin Ducks were more abundant in eastern North America although exact past population size remains speculative because of lack of quantitative data for the 1800's and early 1900's (Goudie 1989). Early writers commented on the need for full protection for Harlequin Ducks in the northwest Atlantic (e.g. Phillips 1925, Peters & Burleigh 1951).

The advent of the Migratory Bird Convention (1916) between Canada and the United States set the stage for recovery of some waterfowl species such as eider ducks (*Somateria mollissima*) and Wood Ducks (*Aix sponsa*) that were subsumed under specific clauses. The Harlequin Duck was not the focus of conservation and recovery efforts, and remained at critically low levels throughout the present century (Goudie 1991).

By the time of early ornithological explorations, the distribution and abundance of Harlequin Ducks breeding in eastern Canada had probably retracted considerably (see Peters & Burleigh 1951). For example, Merriam (1883) reported the Harlequin Duck to be a common

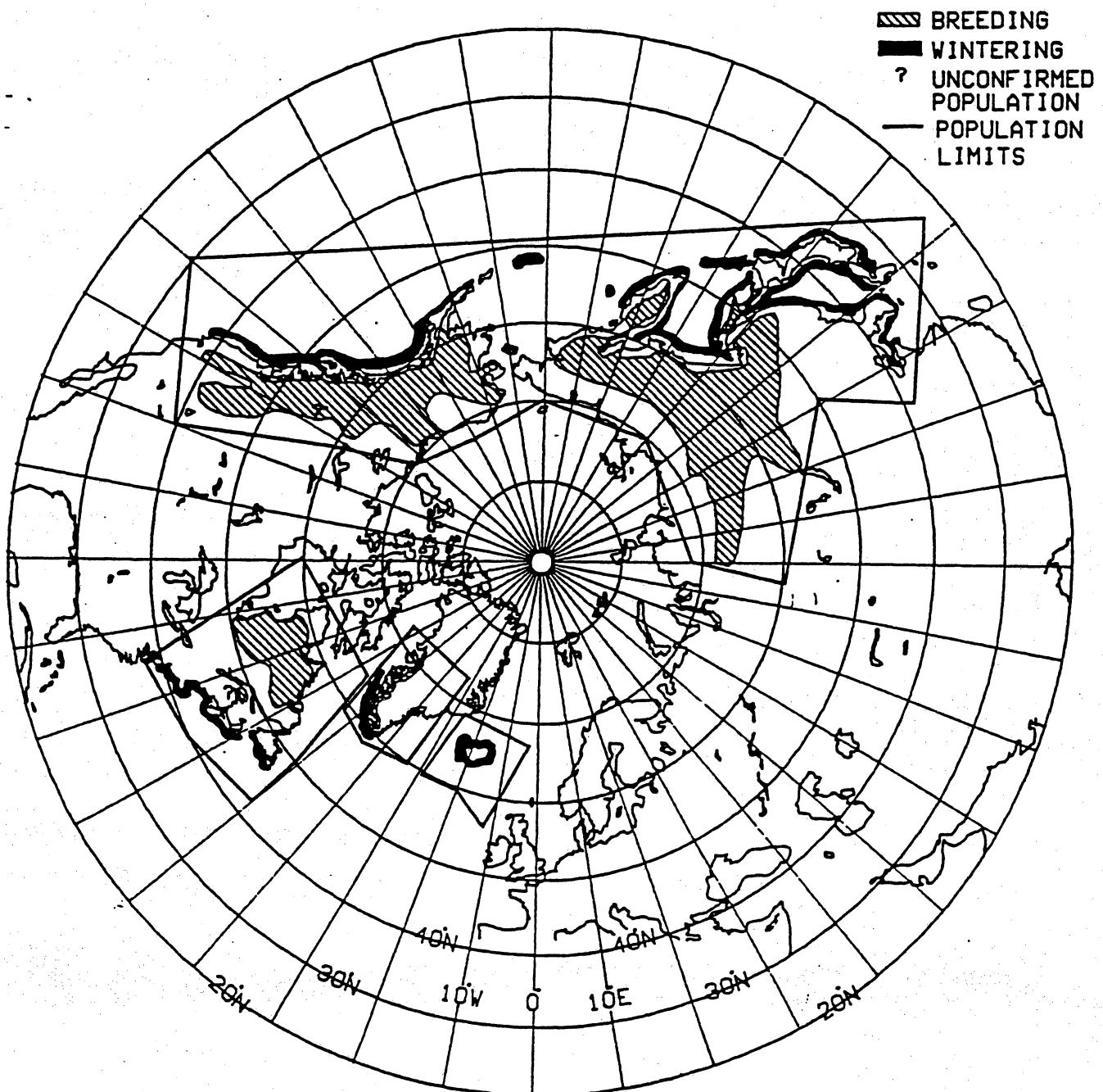


FIG. 1 HARLEQUIN DUCK WORLDWIDE BREEDING AND WINTERING DISTRIBUTION

breeder in the interior of insular Newfoundland. The significant historical presence of Harlequin Ducks is strongly entrenched in folklore where the species was commonly referred to as "Lord & Ladies". The Harlequin Duck was not thought to have been seriously pursued by hunters (e.g. Phillips 1925) but nevertheless it was a significant incidental component in the kill of coastal wildfowlers (see Goudie 1991). Areas including coastal Newfoundland and Labrador, the Maritime Provinces, and New England were the subject of hunts that increased winter and spring mortality to Harlequin Ducks on their migration and on staging and wintering habitats.

Declines in Harlequin Ducks in eastern Canada were likely exacerbated by the impact of huge hydroelectrical developments in core areas of breeding distribution in Labrador and northern Quebec. Habitat loss due to inundation and diversion was massive, and such losses were unquantified due to infancy of environmental impact assessment legislation and public awareness.

2. Current

Harlequin Ducks presently breed in discreet areas of eastern Canada (Figure 1) in very low densities, i.e. one pair per 10 km of river where present. The most retracted breeding distribution is probably on insular Newfoundland where only a few pairs remain.

Harlequin Ducks are now extremely rare in eastern Canada and the total population of eastern North America is estimated at less than 1000 individuals (Goudie 1991). In winter, Harlequin Ducks display strong philopatry to specific marine coastal areas (e.g. Breault & Savard 1991, Palmer 1976 and others). Current winter distribution of Harlequin Ducks in eastern Canada is retracted to a handful of areas that are remote and/or protected from hunting hence functioning in a manner consistent with wildlife refugia.

Population status

Harlequin Ducks are listed as endangered in eastern Canada (C.O.S.E.W.I.C. 1990) due to small population size (< 1000) and apparent declines. Trend data are limited to counts of winter concentrations, primarily through Audubon Christmas Bird Counts (C.B.C.) which indicate long-term declines in Newfoundland and Nova Scotia (Figures 2a and 2b). At present in New Brunswick, Harlequin Ducks are only recorded to occur at the Wolves, a remote archipelago in Passamoguoddy Bay where intermittent surveys suggest declines are apparent (C.W.S. files).

About half of the population breeding in eastern Canada winters in the area of Ile aux Haut, Maine where a declining trend is apparent (Figures 3A and 3B). Some small increases have been apparent in southern New England between 1979 and 1985 (Vickery 1988).

Productivity

Sea ducks display a life history pattern similar to seabirds. A K-selected pattern of deferred maturity and low annual recruitment rates is a prominent feature in the Harlequin Duck. Limited data for Harlequin Ducks breeding in Labrador supported that on average only 12.3% of females had broods (1987: 31.3%, 1988: 4.9%, 1989: 11.8%). This suggested extensive non-breeding and/or high egg and duckling mortality similar to studies in Iceland (Bengtson 1972; Gardardsson and Einarsson 1991). For successful breeders we recorded a mean brood size of 4 ± 1.59 (S.D.), range 1 - 7, N=16.

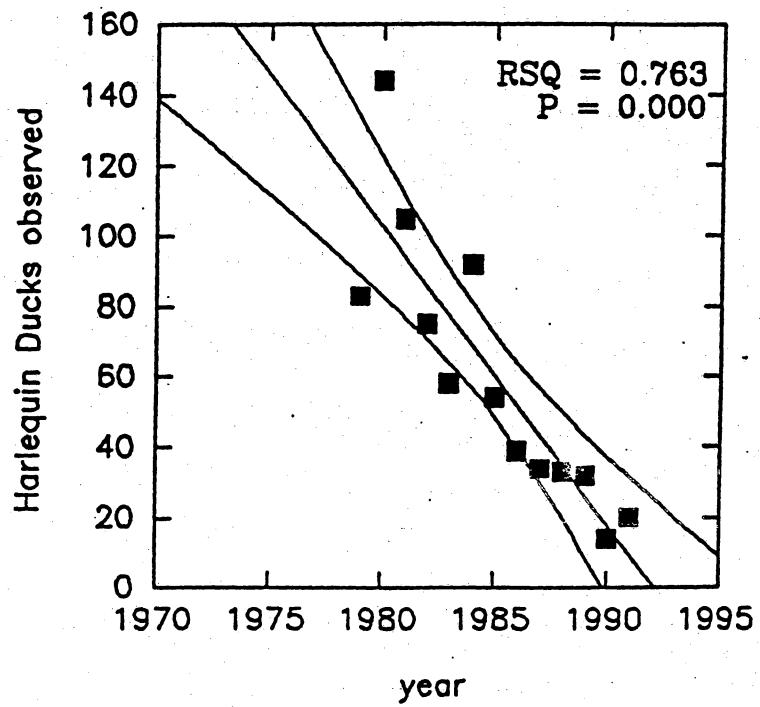


Figure 2a. Christmas bird counts of Harlequin Ducks, Newfoundland

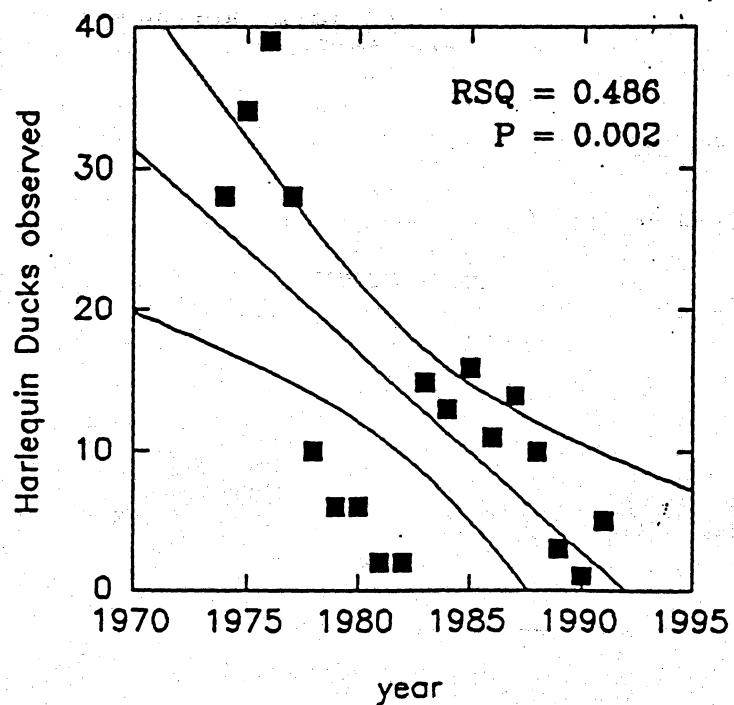


Figure 2b. Christmas bird counts of Harlequin Ducks, Nova Scotia

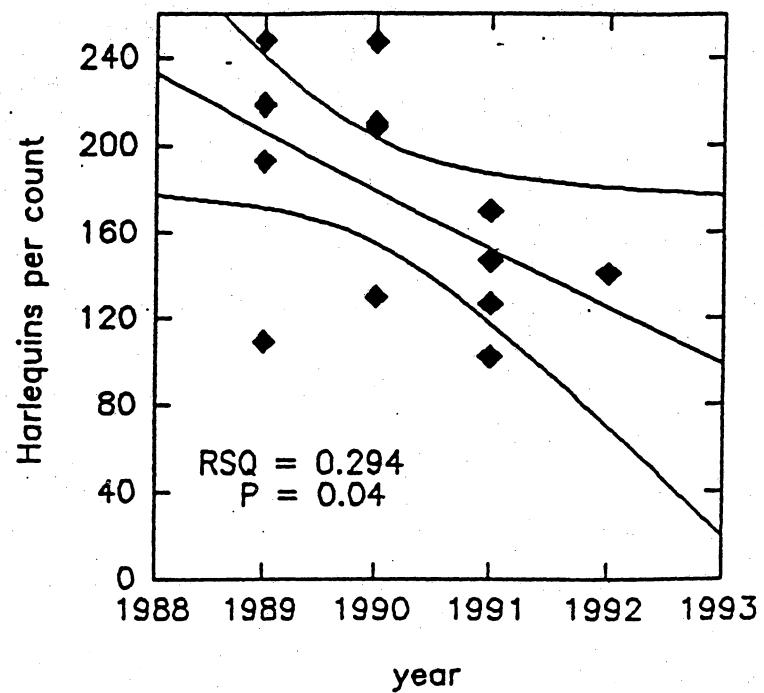


Figure 3a. Shorebased counts of Harlequin Ducks from Isle au Haut, Maine, January to March

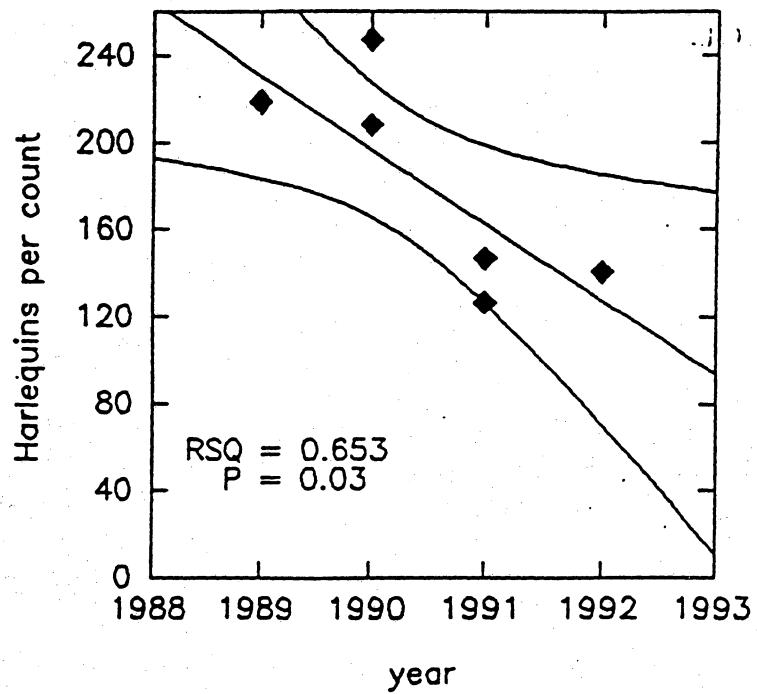


Figure 3b. Shorebased counts of Harlequin Ducks from Isle au Haut, Maine, March only

Mortality and Harvest

No Harlequin Ducks have been banded in eastern North America. Under natural conditions juvenile mortality is thought to be high. For example, in Iceland Gardardsson (1992) calculated a mean of 1.1 fledged young per female Harlequin Duck over his 14 years study. Such a low productivity must be balanced by high adult survival. For example, the related eiders (*S. n. mollissima*) in the Farne Islands, England displayed an average annual survival of 89.5% over the 1958 - 1980 period when the population averaged annual increases of 4% (Coulson 1984).

Harlequin Ducks were subjected to various levels of incidental sport harvests up to the late 1980's. Such levels could very well account for the declines in the eastern North American population (Goudie 1991). Aboriginal and subsistence harvest remains unaffected by current legislative protection in Canada. Illegal shooting is apparent in Atlantic Canada in recent years (C.W.S. files).

Management

To present there has been little effective management of the Harlequin Duck in eastern Canada. Due to the potential implications for all seaduck hunting, protection status designation met with strong opposition from both some provincial and federal levels. This delayed the submission of the Status Report to the Committee on the Status of Endangered Wildlife in Canada (C.O.S.E.W.I.C.) from 1987 to 1990. Endangered status was applied in April 1990 and the final version of the National Recovery Plan for the Harlequin Duck (*Histrionicus histrionicus*) in eastern North America is expected by spring 1993. Therefore, actions to date

have been scanty and limited to the legislated end of legal sport hunting. Enforcement of such laws is however seriously lacking in the remote rural areas where Harlequin Ducks are more prevalent. The need for a strong education program is apparent but no progress is yet evident.

Threats

A number of factors converge in eastern North America to further threaten the population of Harlequin Ducks. The lack of a hunter/public education system and vigilant enforcement presence results in poor compliance to the hunting closures. Identification of Harlequin Ducks, especially females and immatures, remains ambiguous at best.

To date, only the Wolves in Passamoduddy Bay, New Brunswick have been closed to all hunting. The lack of a standardized monitoring system to corroborate C.B.C. data hampers the refinement of knowledge of critical areas and migration routes.

The consistent use of traditional wintering sites leaves the remnant Harlequin Duck population especially vulnerable to illegal hunting and oil pollution. Chronic oil pollution is especially problematic in southeastern Newfoundland, where frequency of oil contamination has increased over the last ten years. Such sites as Ile aux Haut, Maine that support 50% of the wintering numbers could be devastated by a single catastrophe.

Further north, the breeding grounds are not immune to major impacts. Hydroelectrical development impacts were not estimated for the Upper Churchill River, Labrador and James Bay I, Quebec developments. Recent censuses of 56 pairs of Harlequin Ducks in the proposed James Bay 2 development could devastate habitat of some 25% of the remaining breeding population in eastern Canada. No mitigation techniques are known. Acid rain may negatively

impact on breeding habitats where waters lack buffering capacity. In some areas of the Labrador- Ungara Peninsula, biting fly control programs, such as a 35 km radius of Churchill Falls in Labrador, further threaten to destroy the larval insect food base important to breeding Harlequin Ducks.

Continuing declines in Harlequin Ducks in eastern Canada and a management system slow to respond to apparent needs do not shed a bright light for the future of this population. In the foreseeable future, our fragmented knowledge will further restrict abilities to take decisive actions. Baseline data gathering will likely proceed over a period when the population of Harlequin Ducks in eastern North America falls even further below minimum viable numbers.

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PRELIMINARY STATUS AND DISTRIBUTION OF HARLEQUIN DUCKS ON SELECTED BREEDING RANGES IN THE CANADIAN ROCKIES

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Area of study

This paper summarizes the current known status of the harlequin duck on summer breeding habitats in Alberta and eastern British Columbia. These habitats form the eastern limit of harlequin duck breeding range in western Canada. The study area contains a number of large National and Provincial Parks. Covered in this report are 7 National Parks (Jasper, Banff, Waterton, Kootenay, Yoho, Revelstoke and Glacier) and 2 Provincial Parks (Kananskis Country and Mount Robson). Most of the available information on harlequin ducks within the Canadian Rocky Mountains has been generated from these parks. Information sources included historical records, field surveys and discussions with local sources.

General Life History in Study Area

Harlequin ducks use the study area during their breeding, nesting, and brood-rearing phases. They generally arrive in small groups of pairs and bachelor drakes during early May. Although little is known about their migration routes, it is assumed that they migrate inland along major river drainages. at least a portion of their journey is over land however, as they are regularly observed east of the Continental Divide.

Immediately after their arrival, small groups of harlequins will stage at open water areas along the main river valleys.

Gradually the pairs disperse into smaller class rivers and lakes at higher elevations. Courting behavior is evident from arrival until mid-June. Nesting is initiate throughout June. The drakes depart the breeding ranges and migrate back to coastal areas by mid-July. The first broods are usually observed in late July to early august. Fledging occurs from late August well into September. Hens and broods depart the area shortly after fledging.

Scope of Research

Much of the historical data are from National Park Biophysicals, Warden Service Records, local expert knowledge, and a variety of interim reports and governmental documents and records.

HISTORICAL DISTRIBUTION

General

Harlequin ducks are considered fairly common summer visitors to

the Canadian Rockies. Between 1971 and 1978, the Alberta Bird Atlas (1992) documents 18 sightings throughout the Rocky Mountains.

Mount Robson Provincial Park (MRPP)

We were unable to locate any historical information, however Breault and Savard (1991) report a record of 1 female and 4 juveniles on a stream near Berg Lake (elev. 1610 m) on August 1 and 3 of 1974.

Jasper National Park (JNP)

A Canadian Wildlife Service (CWS) report notes that in 1943 and 1944 harlequin ducks were observed on Topaz Creek, Maligne River, Brazeau Lake, and Southesk Lake. In 1943, three females seen on Brazeau Lake on July 31 were the only harlequins encountered all summer, but in 1944, 10 individuals were noted during May, June, and July. On July 19, 1944, a hen with 3 downies was observed on the Rocky River above Rocky Forks. In 1946, two females and eight males were seen on Medicine Lake on June 6 (CWS, 1955).

Holroyd (et al. 1979) observed at least 18 pairs of harlequin ducks on the Athabasca River between the Milette and Snaring Rivers during a canoe survey in June, 1978.

The Warden Service computer files list 34 observations of harlequin ducks between 1976 and 1990 (Clarkson, 1992).

Banff National Park (BNP)

Harlequin ducks are commonly observed along the Bow River. Between 1964 and 1974, Gordon (1975), reports 15 observations of harlequin ducks in Banff National Park. Most of these observations are along the Bow River. In 1973, Seel and Gordon observed at least 5 pairs while canoeing [the Bow River] between Lake Louise and Redearth (Gordon, 1975). In 1974, harlequins were observed on Warden Lake and Bow Lake. Gordon (1975) felt that it was likely that harlequins were nesting on the higher lakes after staging along the Bow River in May.

Holroyd and Gartshore (interim report, 1978) reported seeing 14 pairs, 7 single males, and 2 single females (total HADU=23) between the Trans-Canada highway bridge at Lake Louise and Eisenhower Junction during a canoe survey on June 1, 1977. Very few harlequin ducks were observed downstream of Eisenhower Junction. Reports from 1986 indicate that at least 25 harlequin ducks were observed on the upper section of the Bow River in late May (Bow Valley Naturalist Newsletter, 1986).

Banff Warden Service records indicate 40 observations from 1975 to 1990. Most of these observation are along the Bow River between Lake Louise and Canmore.

Yoho National Park (YNP)

The Yoho Warden Service records indicate 36 harlequin duck observations between 1972 and 1985; 23 of these are from Lake Ohara (elevation 2000m), including two separate observations of females with 5 juveniles in 1975 and 1978. A group of 10 harlequin ducks were observed at Lake Ohara in 1976 and recorded was "age unclassified" with the comment "fairly small ducks". This observation was likely a female with a brood of nine or two females with a combined brood of eight. With the exception of one observation on Marpole Lake, the remaining 12 observations are from the upper and lower Kicking Horse River, during early summer. This river is most likely used for migration and staging.

Revelstoke/Glacier National Parks (RGNP)

The RGNP Biophysical Report (Van Tighem and Gyug, 1982) states:

The harlequin duck was recorded by Munro (1942) as a regular nesting species on the Illecillewaet River at Glacier. A female with a brood of young was observed near Glacier Station on 20 July 1942. Another brood was seen in early June 1942 on Flat Creek. The species is most common in May, when pairs gather along the Illecillewaet and Beaver Rivers prior to dispersing, the females to breed along the rivers and smaller streams of the park and the males to the Pacific Coast. No more than 10 pairs have been recorded on a single day on either river. The species probably breeds in small numbers throughout the parks but the only recent observation of a female with a brood was one seen in 1981 on Connaught Creek (KVT).

Warden Service records document 27 separate harlequin duck sightings in Revelstoke and Glacier National Parks. Most of these observations are on the Illecillewaet River, which runs through both parks. There are also 2 observations on the Woolsey drainage in RNP, 2 observations on Mountain Creek in GNP, and 7 sightings from the Beaver drainage in GNP (note-two of these observations were on the sewage lagoon at the Rogers Pass Maintenance Compound).

Kootenay National Park (KNP)

There are approximately 10 observations of harlequin ducks on record at Kootenay National Park. The earliest documented arrival was a pair at the Iron Gates, Sinclair Creek on May 12, 1982 by L. Halverson. K.E. Seel (1965) reported observing one female with up to 5 ducklings on Sinclair Creek from late August to mid-September in the years 1959 to 1962. In 1963, Seel also recorded seeing 1 female and 5 ducklings on McKay Creek at an elevation of 2000m.

Waterton Lakes National Park (WNP)

There are only 4 observations of harlequin ducks in the Warden

Service computer records. The largest single count was 12 (8 males, 4 females), observed at the outlet of Lower Waterton Lake on 16 May, 1979 (elev. 1300m).

Harlequins are often observed on upper Blakiston Creek above the falls (elev. 1550m). This is likely a nesting area as a brood of 2 ducklings was seen in 1990 and Seel reports several broods in this area from 1967-69. Holsworth recorded harlequin ducks as common in the Blakiston valley area as early as 1957 (Watt pers. comm. 1992). Other records within WNP are from Emerald Bay on upper Waterton Lake, the outlet of Knights Lake, and one brood observed at Little Crypt Lake (elev. 1750m).

Kananaskis Country (KC)

Ealy (1977, pers. comm. 1992) recorded over 50 observations of harlequin ducks in the Sheep River area in southeastern Kananaskis Country during his research in 1975 and 1976. Ealy (1977) noted brood sizes ranged from 1 to 7 ducklings, and water bodies utilized ranged from 10 - 100m across with shallows and pools of various depths.

CURRENT DISTRIBUTION

Harlequin duck surveys were conducted in JNP during 1991 and 1992. In 1992, park personnel in the surrounding study areas were requested to document current harlequin duck sightings within their park. A summary of those observations are as follows:

Mt. Robson Provincial Park

Field staff stationed at Berg Lake observed 3 pairs in 1991 and 2 pairs in 1992. At least 1 brood was observed each season. In 1991, JNP wardens received several observations of pairs on Fortress Lake, Hamber Provincial Park (which is immediately south of MRPP but under the same administration).

Jasper National Park

In 1991, the JNP warden service initiated a study to determine the status and distribution of harlequin ducks within Jasper National Park. This effort documented numerous observations of pairs, distributed widely throughout the park. The largest concentrations were observed in the Maligne Valley. Groups of pairs were often observed feeding at lake outlets and river mouths. Harlequins were noted to use staging areas at lower elevations in May. Breeding chronology appears to be somewhat later than in other areas, although similar to findings in Grand Teton National Park (Clarkson 1992). Lake use by harlequins was common throughout the breeding season.

Banff National Park

During the 1992 field season Banff Park Wardens conducted canoe surveys along the Bow River from Lake Louise to Castle Junction.

Incidental observations from other areas in BNP were also recorded. Highest single counts was 57 (12 pairs, 32 males, 1 unknown) along the Bow River on June 8.

Yoho National Park

Minimal harlequin duck survey was conducted in YNP during 1992, and there were no reported sightings. The lack of sightings in the Lake Ohara area is worth noting however. Alan Knowles (pers. comm. 1992) has been the Lake Ohara District Park Warden for many years (see historical data). Knowles reports that until about 1985 he would regularly see 4 to 8 pairs of harlequin ducks on Lake Ohara in early spring. At least one hen usually remained each year to nest along the south shore of the lake near the outlet of several small creeks. Since 1985, Knowles has not observed a single harlequin duck in the area. Observations of other waterfowl species (including mergansers, goldeneyes, and blue-winged teal) have, however remained constant.

Lake Ohara (elev. 2014m) is relatively small (1 km x 600 m) subalpine lake bordering along the steep west slopes of the Continental Divide. A number of facilities are concentrated along the lakes' south shore. Vehicle access is restricted to public buses only and the entire area is subject to a daily quota system (which is constantly reached during the summer). The Lake Ohara area supports a variety of recreational activities (hiking, picnicking, fishing, bird watching) and has been popular with users for many years. A heavily-used hiking trail circles the entire lake. The disappearance may be due to prolonged human disturbance, or perhaps out-of-park influences on the wintering range.

Revelstoke and Glacier National Parks

Incidental observations resulted in no harlequin duck sightings during the 1992 field season.

Kootenay National Park

Current data are not available for KNP.

Waterton Lakes National Park

In June of 1992, WNP wardens conducted a migratory bird survey throughout the park. This survey covered a number of areas where harlequin duck have historically been sighted. Observers recorded sighting 2 pairs and 4 drakes. The known park breeding population is estimated to be approximately 3 pairs, although not all streams have been surveyed in a systematic fashion (Watt pers. comm. 1992).

Kananaskis Country

The current data were collected primarily from the Elbow district in Kananaskis Country. This area is approximately 25km north of the Sheep River drainage where historical sightings were recorded. In 1992, at least one pair was observed along the

Elbow River. A brood of 5 ducklings was observed on the river in August.

POPULATION STATUS

Limited baseline data exists within the study areas. A small number of areas within BNP and JNP account for the largest populations within the region. Surveys in JNP found a maximum of 17 pairs concentrated in a few location of the Maligne Valley during 1992. Populations elsewhere in the park appear to be more widely distributed (Clarkson, 1992). In BNP, 57 birds were observed along a 30 km section of the Bow River on June 08. Sightings elsewhere in the park are limited to a few pairs (Volker, 1992). It appears likely that populations within the Canadian Rockies are generally sparsely distributed. Some exceptions exist however, and these relatively small areas support significantly larger numbers.

PRODUCTIVITY

Available data from the study area are very limited and based on occasional random sightings. As yet, no effort has been directed towards determining productivity within the study area.

MORTALITY AND RETURN RATES

There are no current records of harlequin duck mortalities within the study area. One drake was observed entangled in fishing line at Maligne Lake in JNP. The bird was observed swimming and diving with a mate.

No birds have been marked or banded within the study area, nor have any marked birds been sighted.

HARVEST

Hunting and egg collection is illegal throughout most of the parks included in this report. At this time, illegal harvesting of harlequin duck eggs is thought to be minimal.

MANAGEMENT AND THREATS

Harlequin ducks and their habitat are protected from consumptive resource extraction within the parks system. The most significant threats within the parks include: commercial/facility development near critical habitat, disturbance from recreation river users (fishing, hiking, private and commercial boating, commercial rafting, nature appreciation, etc.), and water pollution. CPS interest in harlequin duck ecology is generating baseline data collection throughout many of the mountain parks. JNP has established special environmental assessment guidelines to ensure impacts on harlequin ducks from humans are limited. As

well, to protect critical harlequin duck habitat in JNP, the Maligne River, between Maligne and Medicine Lakes, has been designated a "Special Preservation Area". The river, and a 30m shoreline buffer, is now closed to all activities from May 1 to July 1.

Elsewhere in Alberta and B.C. (outside of park refuges) harlequin ducks and their habitat are subject to a number of potential human-related threats. These include: logging, mining, oil and gas exploration and extraction, agriculture, hydroelectric development, water pollution, shoreline development and water-based recreation. No special designation exists for the species.

Poaching of harlequin ducks (and their eggs) is also believed to be on the rise. At a recent wildlife enforcement officer training course in Fredericton, New Brunswick, CWS personnel identified an increase in the trafficking of harlequin duck hides (Hindle, pers. comm. 1992). Apparently this is in response to a growing demand by native Americans for feathers to decorate ceremonial costumes. Since traditional sources (primarily raptors) are now illegal, persons are harvesting harlequin ducks in the Atlantic provinces to meet these needs. Figures and prices are unavailable.

INFORMATION NEEDS

These include:

- baseline data on status and distribution
- harlequin duck ecology and productivity data
- identification of critical habitat
- habitat suitability modelling information
- cooperative effort and information exchange between regions

Any management action must reflect the migratory nature of this species. A comprehensive, multi-agency management plan is required to ensure that the harlequin duck is protected throughout its summer and winter range. The absence of harlequin ducks at Lake Ohara in Yoho National Park serves as a grim reminder of this fact.

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